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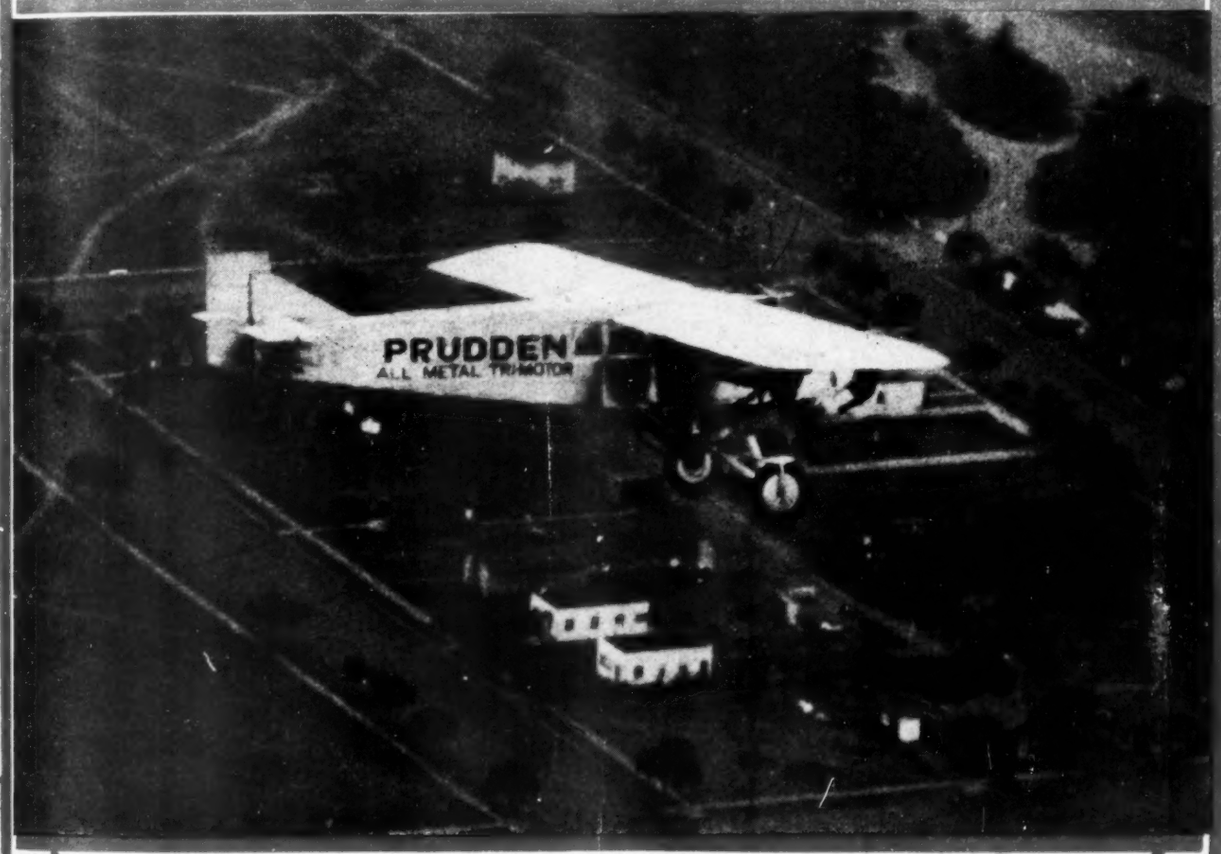

The Prudden-San Diego Airplane Co.'s all metal monoplane over San Diego, Calif.

VOLUME XXIV NUMBER 6

Special Features

Campaigning for an Airport
The Martin "Eureka" Section
Notes on the Guggenheim Safety Competition

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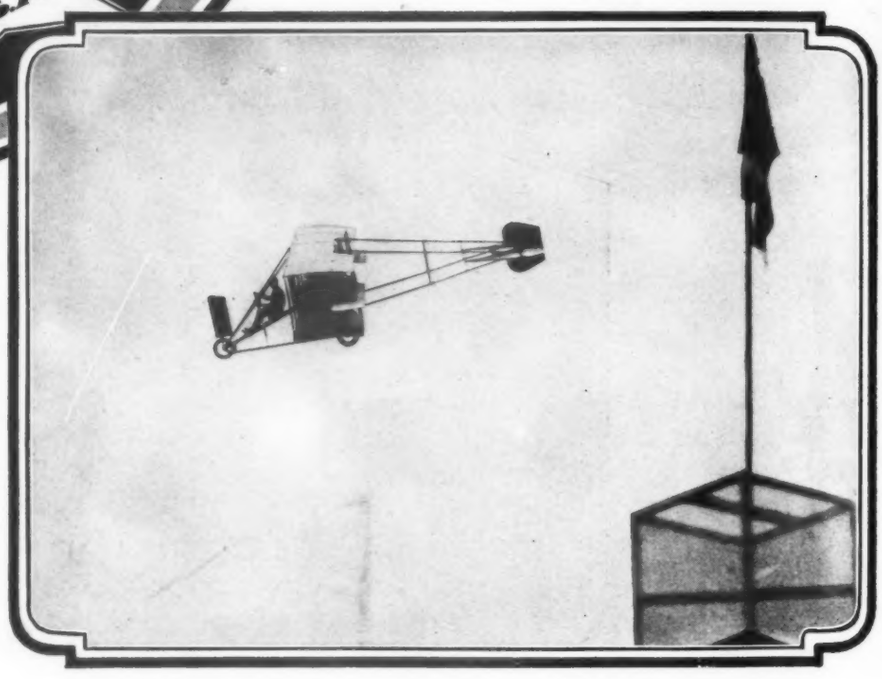

Glenn L. Martin winning the Grand Derby at National Meet, Cicero Field, Chicago, Illinois, July, 1913.

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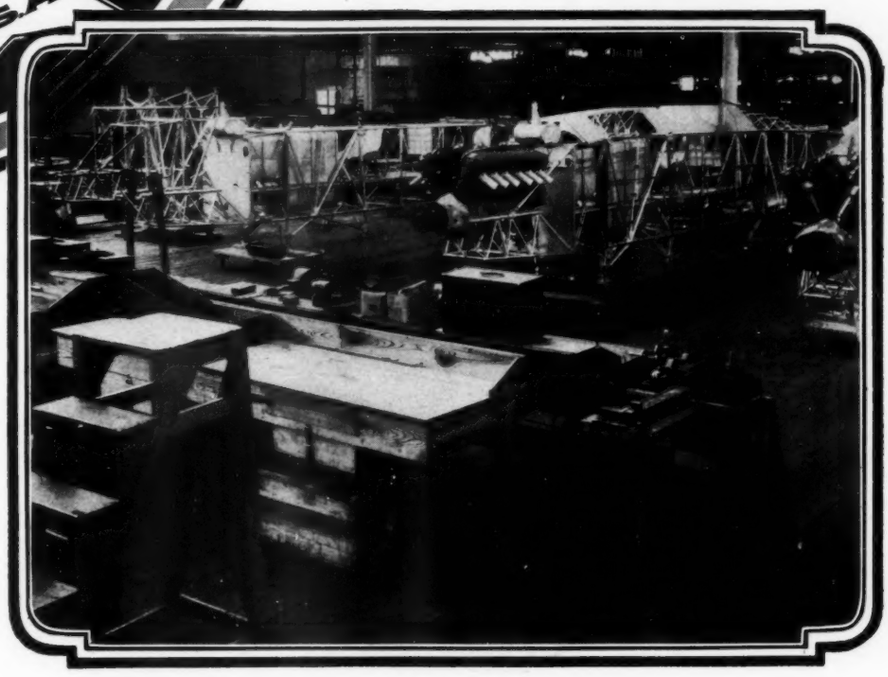

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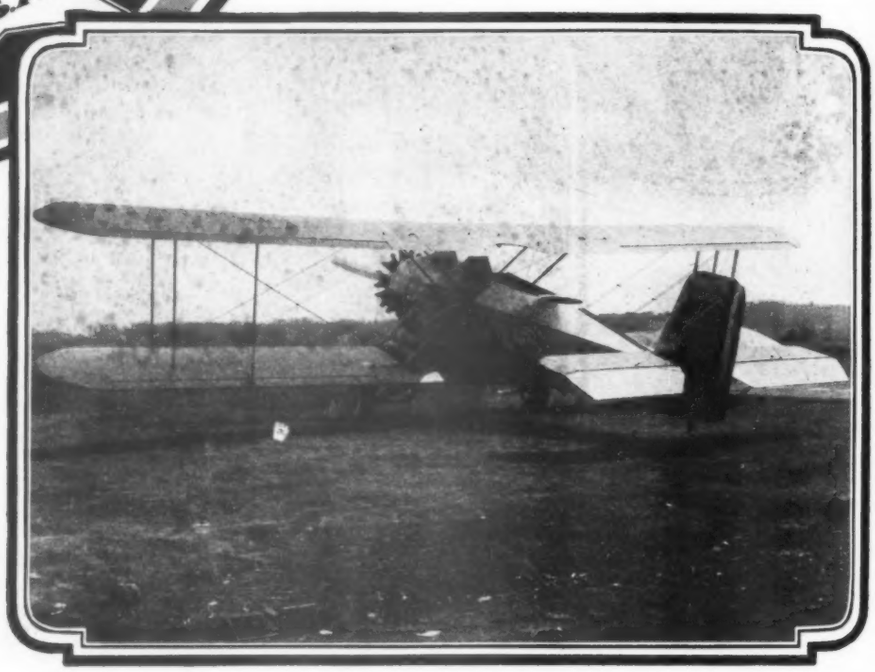

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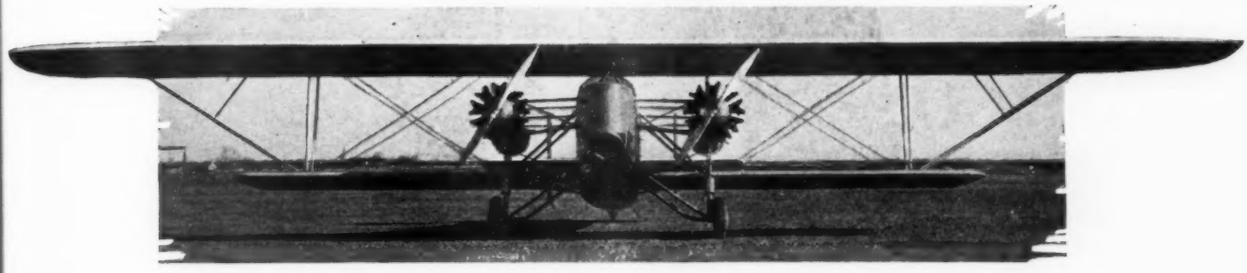

SIKORSKY Bombardment Plane Type S37B

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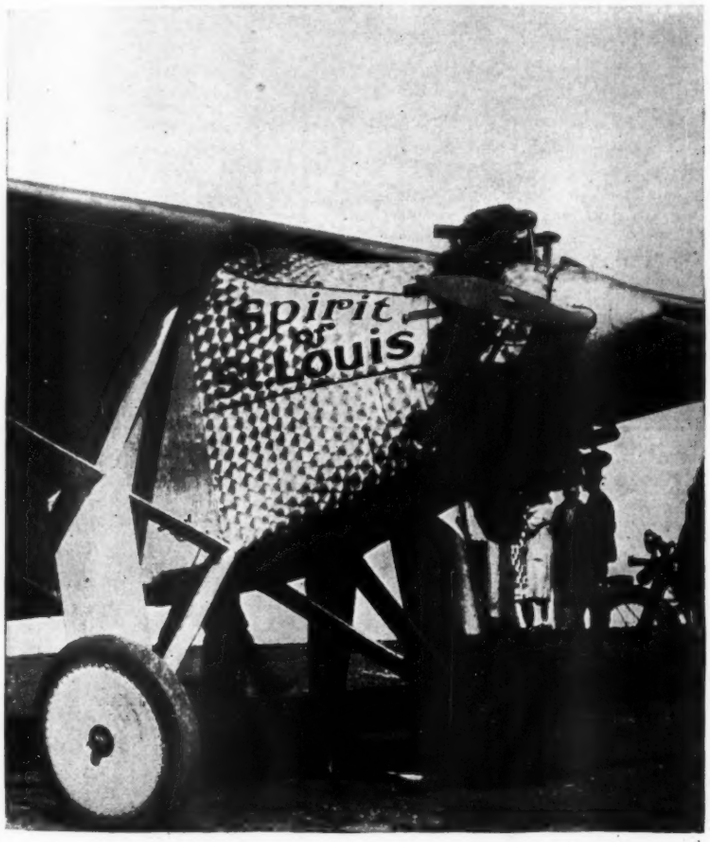

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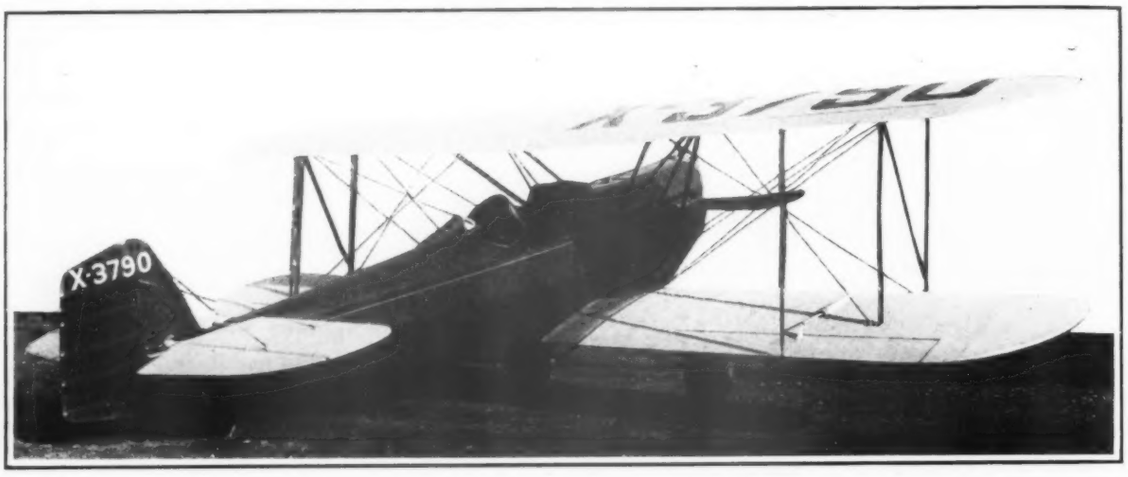

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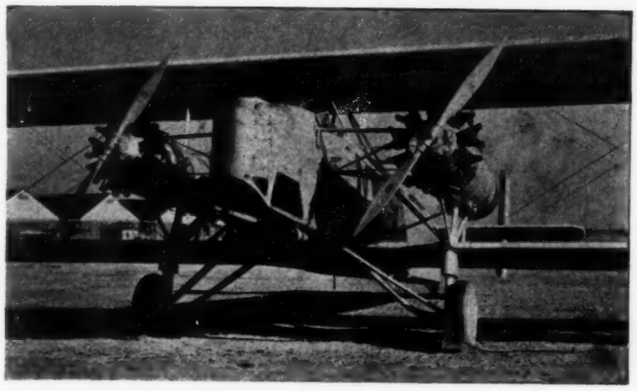

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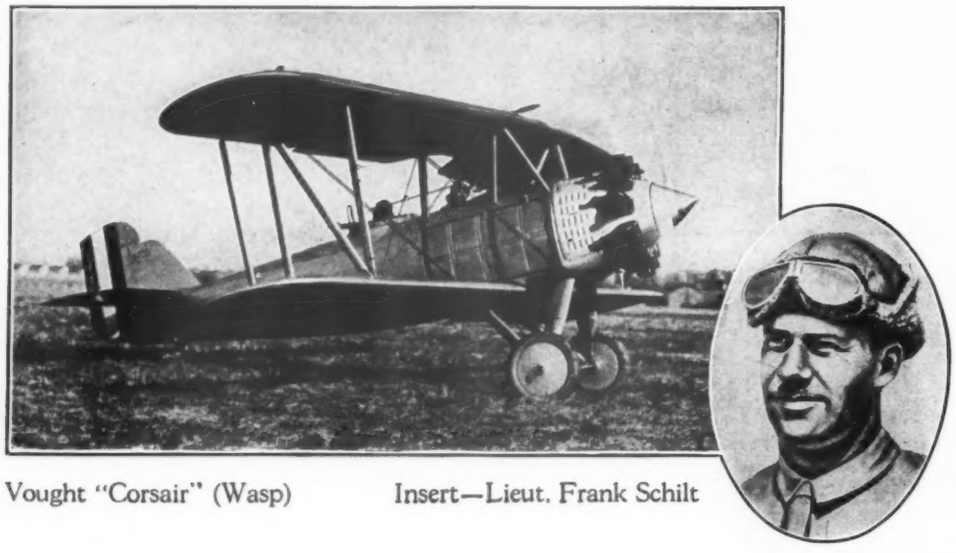
The MARINES and the "CORSAIR" in NICARAGUA



Vought "Corsair" (Wasp) Insert—Lieut. Frank Schilt

"The engine ('Wasp') pulled the plane out of the field almost like a helicopter"

Lieut. Frank Schilt

Lieut. Frank Schilt, U. S. M. C. reports that, in a Vought "Corsair," he rescued a number of wounded Marines in the mountains of Nicaragua after landing and taking off for a total of ten trips on a rough, quickly prepared run-way 70 ft. wide by 300 ft. long. This improvised field was entirely surrounded by dense forests and high, rugged mountains.

Low landing speed, coupled with quick take-off, is best exemplified in ships equipped with the air cooled radial engine, and is due primarily to low installed weight per horsepower. In hard service flying these characteristics are vital to the practical use of aircraft during actual engagement where perfect landing fields are never available. These same engine characteristics provide for the unmatched performance of the "Wasp" at altitude, and constitute the reasons for the "Wasp's" excellence in comparison to relatively heavier types of power plants.

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AVIATION

The Oldest American Aeronautical Magazine

Vol. XXIV *FEBRUARY* 6, 1928 No. 6

Obsolete Stocks

THE AERONAUTICAL industry has not as yet reached the stage where airplane dealers and flying field service stations carry large stocks of spare parts, etc., but with the rapid strides forward that are being made in reference to manufacturers obtaining national distribution it does not seem far distant when such a condition will be necessary. And when that time comes, the service station manager in particular should be most careful in the selection of his stocks.

Quick turnover is the objective of the automotive service station and so will it be with the airplane service station. Slow selling and obsolete stocks are a drag on the profits for they represent stagnant capital. One way to prevent such a condition, or at least alleviate it to a considerable degree, will be for the service station operator to make a sales analysis of his territory and determine as near as possible what parts he should push. Another way, and perhaps one which might be used in connection with the territory analysis, would be for the service station operator to keep a strict check on the moving of his stock by the installation of a perpetual inventory system. By it he can tell what is moving fast and what is not. It will also give him some idea as to when he should expect seasonal depressions, and prove a most valuable guide in his buying of additional stocks. Of course there is an expenditure connected with the operation of a perpetual inventory—the exact amount being dependent upon the individual concern—but if maintained with a fair amount of accuracy it will pay for itself before long, if in no other way than to enable the service station operator to work his capital instead of having part of it tied up in slow moving and obsolete stocks.

The New Schools

ALTHOUGH THERE have been many commercial flying schools scattered throughout the United States there were none up until 1927 which habitually gave a thorough and comprehensive course such as is necessary to turn out a finished flier. The cause for this situation was the great reserve of war trained fliers, the ease with which an inexperienced pilot could go out and barnstorm and the lack of demand for well trained pilots. The competition between the many schools resulted in their competing to see which could solo their students for the least money and apparently there was not a sufficient demand for adequate training to warrant a first class school. It has even become a generally accepted idea that soloing completes the duty of a school and that three or four hundred dollars is an ample charge for the turning out of a pilot.

There is beginning to be a change however and several schools are trying to establish courses which will really turn out well trained fliers. This is now possible because there is no longer an immense reserve of war time pilots and what is more important there is a demand for skilled pilots from air transport lines, from flying fields and schools and from large non-aeronautical companies which are using planes in their business. The Department of Commerce regulations and the exhaustion of cheap war surplus planes is also making it much harder for a pilot to merely solo and then going out and earning money while he is getting his experience and training. The old type school who merely soloed their students will continue to do as large a business as ever in instructing private owners and those who wish to learn how to fly as an incidental to their business but the school training of those who expect to become professional fliers will certainly become more elaborate.

The new type of school will have to overcome the ideas which have become firmly imbedded during the past years. They will have to persuade would-be students that there is a great deal that can be taught beyond soloing. They will have to teach a great deal of theory as well as giving several hundred hours of actual flying. They will have to flunk out a great many students as is done in any professional college or in the military flying schools. All this will cost money but a professional flier who can fly all kinds of planes in all kinds of weather is not made in a day.

On the Engine Situation

WAR SURPLUS engines are becoming very scarce. Airplane manufacturing programs are being retarded by the lack of available power plants and engine designers are making every effort to develop a product to meet this demand. Daily we hear of new air cooled engines under development. It is inevitable that some of these will not come up to standard and should they find their way into service before they are fully developed, a considerable amount of harm will be done. Power plant failures, which perhaps might end disastrously, effect the prestige of both the airplane and engine manufacturer. At the same time the industry as a whole suffers through the loss of public confidence.

For a long time the aeronautical industry has been endeavoring to increase the confidence of the public in the possibilities of the airplane. During the past year aviation has found numerous new supporters, many of which will make their few flights in new production planes during the coming year. These people will be getting their first hand information in aeronautics and to destroy their confidence would be to lose the support of those who will help to make commercial aeronautics a paying industry.

An artist's drawing of what Lindbergh Field will look like when completed.

Campaigning *for an* Airport

How the Airminded of San Diego, Calif., Succeeded in Obtaining a $650,000 Airport Bond Issue

By ANDREW R. BOONE

THROUGHOUT THE United States nearly every progressive city is actively engaged in the work of constructing or promoting a municipal airport. No doubt many people, not conversant with the opportunities of aviation, have wondered why there should be such a need for municipal airports. Several potent reasons can be offered, but the most important of these for any given community lies in the fact that others are bending every effort to construct adequate ports for aircraft. Each city of any size must keep step in the competition for supremacy if it plans to keep its place in the nation's progress.

Where towns and cities stood at the beginning of the railroads, the towns and cities of the nation stand today, with reference to development of air transportation for humans, materials and mail. Almost every means of transportation in the United States has received material assistance from the Federal, State or Municipal government. The railroads in extending their lines across the country received millions of acres of land from the federal government. Certainly the automobile, the closest parallel to air transportation, has been assisted by the construction of roads. The airplane, while independent of road or rail construction, is absolutely dependent on terminal facilities—the airport.

Cities have found it good business to provide paved streets for automotive transportation, and to construct highways as these arteries have brought the automobile and consequent prosperity to their midst. Can it be doubted that prosperity has followed the automobile and the train? Can it be doubted that prosperity will follow in the wake of aerial development? The airplane in the same relation to the automobile follows the lines of least resistance and patronizes those cities which establish adequate municipal landing fields.

Airminded Ones Need No Selling

The government, through the department of commerce, has undertaken to develop commercial aviation in the United States by providing airways or properly charted lines of air travel. It is, however, leaving to the initiative of municipalities establishment of local terminal facilities. To those concerned intimately with the new industry of the air the airport need not be sold. There are many citizens scattered through the land who know so little about aviation that they not only must be sold on any campaign for an airport or other development, but they must be kept "sold" until such time as the people have an opportunity to voice their approval of a forward-looking program. In the future the success of city development will undoubtedly be as dependent on the possession of an adequate airport as it has been in the past dependent on the development of adequate port facilities for

ships or the extension of railroads and highways. An airport bears the same relation to air travel that port facilities bear to water commerce. As the airport is designed to serve all types of air traffic, it is usually necessary that it be a municipal undertaking.

Recently the writer had the opportunity to witness an intensive campaign for a municipal airport which proved successful beyond the most sanguine hopes of its proponents. It is a case in point. The campaign took place in a normal American city, among normal American citizens and the voters reacted to the efforts of the "campaign committee" as any group would be expected by an advertising man to react to his efforts to sell a product.

An Airport Must be Sold

The airport is a product. Unfortunately it must be sold; at least, that is true in most cases. Since considerable effort is necessary to "put over" an airport (because it usually involves the expenditure of the people's money through immediate taxation or a bonded indebtedness) residents of other cities will be interested in San Diego's recent experience in voting construction of Lindbergh Field, a "Triple A" airport. It was not an overnight campaign. The same intensive campaign probably will be the experience in most other communities. Usually more than one site is projected by various interested groups; then there are those who object to so-called higher taxation on some general theory which does not seem clear. San Diego's efforts extended over a period of at least three years. In 1924 the San Diego chamber of commerce recognized the promise and opportunity of commercial aviation and appointed an aviation committee. Even then these men looked toward some terminal facilities for aircraft, although it was not until later that their plans began to take definite shape.

Soon after the committee started active work three years ago it was realized that that city must have an adequate airport if it expected to maintain leadership in aviaion. A committee composed of Maj. T. C. Macauley, chairman; Col. Harry Graham, then commanding officer of Rockwell Field, and Capt. S. H. R. Doyle, then commanding officer of the North Island Naval Air Station, was appointed to make a study and survey of possible airport locations. It was determined that an airport in San Diego should be located so that it would combine in one unit facilities for the operation of both land and seaplanes and be as near to the business center as possible. Finally the group decided that the best location to fulfill these requirements was an area at the north end of San Diego Bay on municipally owned tide lands.

In the meantime John Nolen, city planner of Boston, was employed by the city council to draw up a comprehensive city plan and zoning system. As a result of the work of the aviation committee the airport area selected was set aside in a so-called Nolen plan adopted by the city council, for municipal flying activity. From time to time following this act efforts were made to actually commence work on the airport, but no definite action was taken until September, 1926, when the first draft of the Department of Commerce Air Regulations was issued. Included in these regulations were proposed specifications for municipal airports. In order that the city would be assured of having an adequate municipal airport (and here is the importance of having the same group of men follow through on any such efforts) the same committee which had selected the location was again commissioned to study proposed regulations to determine whether San Diego's airport would receive the highest possible rating under those regulations.

What happened? Immediately it was found that the area available on the municipal land would be insufficient to construct an airport to accommodate the air traffic of the future. Immediately adjacent to the municipal land was available a tract of land owned by the United States Marine Corps. It was thought it might be possible to effect some arrangement whereby the Marine Corps property could be made available to the city.

Plan Drawings Made

With this end in view George H. Prudden, aeronautical engineer for the chamber of commerce and head of the Prudden-San Diego Airplane Co., was requested to make a detailed study and draw up specific plans for a "Triple A" airport. Having designed and supervised construction of the Ford Airport in Detroit, Mr. Prudden fitted well into the San Diego air scheme. As the first step in developing plans for the airport, the profile of every street running into the airport was obtained from the city engineer's office. In addition to this the height of all buildings and telephone poles was taken in the area adjacent to the airport acreage. Then

Three men of San Diego who rendered valuable assistance in securing the airport bond issue. Left to right: Roy Campbell, manager industrial division, Chamber of Commerce; W. W. Gibson, president of the local chapter N.A.A., and Maj. T. C. Macauley, chairman Aviation Committee, Chamber of Commerce.

a chart was developed giving the maximum height of any obstruction within one mile of the airport proper. An arbitrary gliding ratio of 10 to one was determined upon and from this the detailed location of the airport selected. It was decided that San Diego's municipal airport should include a circular landing field 3,000 ft. in diameter, an ample basin for the use of seaplanes and an adequate manufacturing and servicing area immediately adjacent to these flying areas.

While these matters, guided to a large extent by Roy Campbell, Jr., industrial manager of the chamber of commerce, who had devoted himself to the airport since he first became a chamber of commerce executive in 1926, were in progress it was found that to fulfill all the necessary conditions it would be necessary to locate the landing field almost totally

Present development of area in which Lindbergh Field will be located.

on government property. More study—and it was found this could be done if authority could be obtained from the Secretary of the Navy. During a period of four months plans for Lindbergh Field were presented to various government departments, with the approval of the commandant of the 11th Naval District. Each department head, in turn, approved the plans, and suddenly the committee found that one of the greatest anticipated obstacles had been removed. Following that success the plans, which also involved a change in bulkhead and pier head lines, they were presented to and approved by the Department of Commerce, the National Aeronautic Association, San Diego chapter, city harbor commission, city planning commission, manager of operations and the common council.

Again, the importance of a complete and comprehensive plan may be noted in the fact that the original plans developed for Lindbergh Field were never changed nor modified by any of these organizations and in each case received unanimous endorsement and approval!

But what is this airport to be? A circular area for the use of land planes, 3000 ft. in diameter, surfaced and drained throughout and equipped with regulation landing and boundary lights. Immediately adjacent to this land plane area a hydro basin dredged to a uniform depth of 10 ft., for the use of seaplanes; 3400 ft. wide and 12,400 ft. long. In addition to the 3,000 ft. landing circle for land planes a runway into the direction of the prevailing wind of 7250 ft. Immediately south of the flying area a territory of approximately 115 acres reserved for aircraft manufacturing.

This complete airport is located only 1.4 miles from the main post office, four minutes by automobile from the main business center of San Diego and one mile from the municipal piers from which shipments of raw materials and engines from the Atlantic seaboard are obtained. The airport is bounded on one side by the main line of the Santa Fe railway, with spur tracks already extending into the aircraft manufacturing area. Street car and bus service is now in operation within one block of the airport. It is also possible to land on or take off from Lindbergh Field without passing over any congested section of the city.

Communication to Secretary of Navy

The cooperation other communities may expect from the naval and military establishment may be noted in the following excerpt from a communication sent by Rear Admiral J. N. McKean, commandant of the 11th district, to the Secretary of the Navy:

"A flying field for the use of civilian, naval and military aircraft, corresponding to the latest plans of the (San Diego) Chamber of Commerce for a Municipal Airport, is provided at the southeast corner of the Marine Corps base and is located mostly on the property of the base and partly on city property. This circular field of 3000 ft. radius is greatly desired by the city and it would be of undoubted military value to the navy in time of national emergency. It could be maintained jointly by naval and municipal agreement and would be adjacent to any field developed for strictly naval use in front of the Marine barracks. Also, the consequent development of aircraft industries in that portion of the town adjacent to the field would provide valuable facilities which could be commandeered in time of war. The aircraft industry section of the city would be advantageously located not only with respect to the proposed flying field but to the large area in the north side of the harbor, which, under this plan, would be dredged to a minimum of six feet and used as a take-off space for hydroplanes."

After the plans had been fully developed and approved definite cost estimates were obtained that a bond election might be called to construct Lindbergh Field. It was found that the development of this area would entail dredging 2,500,000 cu. yd. of mud from San Diego Bay in order to make the necessary fill. After this fill was made the amount needed to surface completely the flying area with six inches of decomposed granite and to provide adequate drainage facilities. Next the cost of installing one 24-in. revolving beacon, boundary lights and landing lights was found. It also was decided that the first unit should include the cost of constructing one hangar 100 x 100, a headquarters building and a rest hut. The following tabulation gives the cost of the work:

Dredging and fill	$525,000
Surfacing and drains	100,000
Hangar, office, lighting equipment	25,000
Total	$650,000

Petitioned to Call for Bond Election

The common council then was petitioned to call a bond election for $650,000, to construct the first unit of Lindbergh Field. The date finally was set for Nov. 22, 1927, and the National Aeronautic Association was requested to assist in the direction of an educational campaign to present to citizens of San Diego the advantages of such a field.

W. W. Gibson, president of the San Diego chapter of the Association was named chairman of the committee and he called together some 40 of the leading business men. A fund of nearly $4,000 was raised by private subscription to defray expenses of the campaign.

The general airport committee was subdivided into five subcommittees as follows: Finance, speakers, publicity, precinct

organization and executive committee which was composed of the chairman of each of the sub-committees. As already stated, the fund was approximately $4,000.

A speaker's manual was prepared for use of the speakers' committee. This gave in detail the type of talks to be made and information about advantages of the project. Twenty-four trained public speakers volunteered their services for the campaign. Each of these was given a manual and at two meetings was asked certain questions to make sure he was entirely familiar with the subject. Each also was furnished a report card to be used in making a report of the meeting addressed that the information might be used by the publicity department. The speaking campaign ran one month immediately prior to the election. Ninety-seven speeches were made to 36,196 people. In addition to this there were nine four-minute talks given over the radio.

One of the most interesting features of this speaking campaign was the presentation of a 680 ft. film entitled, "San Diego—Air Capital of the West." This gave a tour of the aviation industries in the city and showed in detail construction of airplanes and parachutes and the operation of equipment. The close of the film was devoted to an 85 word quotation from Col. Charles A. Lindbergh endorsing the proposed airport. Four prints of this film were shown at four theatres each day for the week preceding the election. Following each showing a four-minute speech appealing directly

A picture of 200 planes over San Diego in 1918 that was used effectively in the campaign for an airport.

for an affirmative vote was given. These theatre speeches are thought by the committee to have been one of the most effective mediums for publicizing the airport.

It was determined that the publicity campaign should be concentrated into the week immediately preceding the election. During that week display advertising space was taken in the four daily papers and in all the weekly papers. One of the interesting features is the fact that airport bonds were endorsed editorially by each of the four dailies, by all the 13 weeklies and by the two labor papers. It is believed that this is the only issue in the history of San Diego which has received the unanimous endorsement of the public press.

In addition to the newspaper publicity and advertising, the committee also prepared 400 window cards which were placed in down-town store windows, while 9200 windshield stickers with the wording "Build Lindbergh Field, More Payrolls" and showing a cut of the Spirit of St. Louis, were placed on automobiles. At the same time 3000 celluloid lapel buttons were distributed at various luncheon and service clubs.

A most important phase of the campaign was found to be the creation of an efficient organization to assist in bringing the voters to the polls on election day. Experience in San Diego indicates that bond issues are usually defeated when small votes are cast. The 205 precincts in the city were organized into 16 districts. Each district was presided over by a manager on election day and he had assigned to him one automobile for each precinct. Each manager was given a complete copy of the Great Register of the precincts in his district. Each precinct worker was handed a copy naming voters in his precinct. On election day the district managers were sent out at nine o'clock to become familiar with polling places. At 11:30 196 automobiles with drivers were assigned to such precincts as were to be covered by this organization. The effectiveness of this organization may be noted in the fact that the biggest vote in the history of San Diego was cast for the airport bonds! A majority of four to one was cast! And it was the only issue of nine separate propositions on the ballot to carry.

This is hardly the place for eulogy, but a word should be said for Roy Campbell, Jr. It was this young chamber of commerce executive who directed the campaign and directed the planning of the moves calculated to bring out a large vote. As a result San Diego will have a "Triple A" airport —and from the lesson other communities may draw their own conclusions.

Curtiss and Consolidated Send Representatives to South America

RECENTLY THE Curtiss Aeroplane Export Corp. announced that it had increased its capital and was planning to seek additional foreign markets in South America. C. W. Webster, president of the corporation, with Lieut. James Doolittle left for South America a short time ago. They were accompanied by Lieut. Leigh Wade representing the Consolidated Aircraft Corp. of Buffalo, N. Y. They will demonstrate planes made by their respective companies to various South American governments. Mr. Webster and Lieutenant Doolittle are demonstrating two planes produced by the Curtiss Aeroplane and Motor Co., Garden City, N. Y., of which the export company is a subsidiary. Lieutenant Wade will demonstrate the Consolidated Husky, PT-3, an elementary training plane. It is powered with a Wright Whirlwind engine.

Mr. Webster has been the president of the Curtiss Aeroplane Export Corp. since its foundation about ten years ago. Lieutenant Doolittle is well known in aeronautical circles for his ability as a racing pilot and as a stunt pilot. It will be remembered that he piloted the Curtiss plane that won the Schneider Trophy race in 1925 and later distinguished himself by being the first man to complete an outside loop. Lieutenant Wade was one of the pilots on the famous "Round the World flight by the Army a few years ago. The expedition is expected to take about six months.

War Flier Takes Sales Position With Fairchild Airplane Corp.

JULIAN R. SPEYERS has joined the sales organization of the Fairchild Airplane Manufacturing Corp. of Farmingdale, L. I., N. Y. Mr. Speyers is a former war pilot having served with the First Aero Squadron, N. Y. National Guard during the Mexican Expedition prior to our entry in the World War.

During the European war Mr. Speyers was a first lieutenant and commanding officer of the 226 Aero Squadron, A.E.F. For some time prior to joining the Fairchild organization he had been connected with the sales department of the Atlantic Aircraft Corp., manufacturers of Fokker planes.

Notes *on the* Guggenheim Safety Competition

Minimum Performance Requirements

By ALEXANDER KLEMIN
Daniel Guggenheim School of Aeronautics, New York University
Assisted by OTTO LUNDE and B. DEMIDORF

(Continued from Last Week's Issue)

Suggestions for Aerodynamic Experimentation on High Lift Devices

WHILE A large amount of data is available on devices to increase lift, there remains a splendid field for aerodynamic experimentation. The following are merely tentative suggestions:

(a) The application of rear flaps, slotted and unslotted, to low lift double cambered airfoils having a high L/D at small angles of attack.

(b) The application of front slot and rear flap to low lift double cambered airfoils having a high L/D at small angles of attack.

(c) Further general experimentation of slots and flaps with a view to securing maximum possible lift.

(d) Study of wing combinations where the central portion has a slot and flap aileron control, with a view to maximum lift combined with ease of control (i.e. low hinge moments).

(e) The application of shielding fins to the central portion of the wing as under (d). In general the application of shielding fins to high lift devices.

(f) Investigation of longitudinal control where high lift devices are employed, "the stabilizer adjustments necessary to guard against violent center of pressure movements", the possible desirability of applying high lift devices to the horizontal tail surfaces.

(g) The problem of so designing slots, openings or passages in the airfoil that the Handley Page-Lachmann effect may be secured without the use of movable parts or loss of efficiency.

(h) Measurement of auxiliary power required, and direct dynamic measurement of lift and drag where suction is artificially applied to prevent burbling; possibility of using a venturi tube to provide the necessary suction.

(i) Measurement of auxiliary power required and direct dynamic measurement of lift and drag where compressed air is ejected to prevent "burbling".

(j) Theoretical, drafting room and wind tunnel studies of combinations of high lift devices.

(k) Testing of Wragg tandem airfoils with greater flap depressions.

(l) A wing with part of the under surface sliding backwards, increasing area and camber, and working in conjunction with a front slot; a variable area wing in which increase in area is combined with the equivalent of rear flap depression and rear flap slotting. In a telescopic wing device, the telescopic portion at least could be combined with a front slot. If the conversion of a monoplane into a biplane is structurally possible, then the application of slots to such a device is conceivable. A rotating cylinder per se, or a rotating cylinder working inside an airfoil is not very promising, but perhaps a rotating cylinder telescoping in and out of a fixed wing might be used to increase lift and steepen the glide when required, although many difficulties immediately come to mind.

Variable Incidence Wings

A wing which varies its incidence relative to the axis of the fuselage has certain theoretical advantages. It enables the fuselage to be kept always at its attitude of minimum drag, and helps to improve efficiency in climb. Once a landing has been made, it may be used as an air brake.

These advantages are quite definitely insufficient to compensate for mechanical disadvantages involved, and while one or two machines (Paul Schmitt, Lanzius, etc.) embodying this principle have been built and flown, it would appear a waste of effort to work on these lines. Some references are appended below ([28]).

Airfoils of Very High Maximum Lift

"Marco Polo" ([29]) an English annonymous writer of considerable ability, is interested in the possibility of utilizing a double cambered symmetrical wing section such as the Martin MP3 of low maximum lift, but having high L/D values at small angles of incidence, and a drag which remains reasonably constant over a fair range at the high-speed end ([30]). With such a wing, without auxiliary devices and a loading of 3.12 lb./sq. ft., he estimates that the speed range required in the competition could be just attained. But for a twin-engine machine with 170 total horse-power, he assumes an area of 577 sq. ft., and a total weight of only 1800 lb. With such wing areas it would be very difficult to keep within this weight, and the light loading would certainly tend to make the machine uncomfortable in gusty air. If lift increasing devices are to be barred, we should imagine that a better line of attack would be in seeking basic airfoils of very high maximum lift. In Table 4 are listed some airfoils of such high maximum lift, together with their minimum drag and maximum L/D. It will be seen that there is little hope in

([28]) *Monoplane de Beer a incidence variable des ailes, L'Aerophile, Dec. 15, 1923.*
An American aeroplane with adjustable wings, by Carl Dienstbach, Sci. Am. Nov. 21, 1914.
The Paul Schmitt variable angle biplane, by Paul Schmitt, Aeronautics, April 15, 1914.
([29]) *The Guggenheim Competition, Some Speculations by "Marco Polo", Flight, June 23, 1927.*
([30]) *Flight, April 28, 1927.*

using these wings of securing anything like the necessary efficiency at high speed, although Gottingen 482, and U.S.A. 40 might conceivably be of interest.

It might be argued that at full scale the improvement in drag for these very heavily cambered airfoils would be very large, so that their inefficiency would not be as bad as that indicated by the wind tunnel. This is probably true, but it is also probably true that the maximum lift coefficients at full scale, drop off for wings of high camber.

Preliminary Calculations for a Design With Front Slot and Rear Flap

The most obvious way to satisfy the requirements of the competition, if a fixed wing surface is to be employed, is to resort to a front slot and rear flap.

We can assume that with this device a maximum lift coefficient of .005 is obtainable.

If the gliding speed is 38 m.p.h., at 16 deg. to the horizontal the monoplane wing loading permissible will be

$$W/A = \frac{Ky\,V^2}{Cos\theta} = \frac{.005 \times 38^2}{.9659} = 7.45 \text{ lb. sq. ft.}$$

Suppose the Wright "Whirlwind" is selected as the engine for the competing plane, and that a rough weight estimate is made. This should run somewhat as follows:—

Power Plant Installation	650 lb.
Pilot's Instruments, etc.	25 lb.
Useful load at 5 lb. per hp.	1000 lb.
Structural weight estimated at 30% of gross weight	725 lb.
Gross Weight	2400 lb.

The wing area required would be 322 sq. ft. It would take clever design to keep the structural weight within 725 lb. particularly when the large wing area is taken into account and the mechanism required for slots and flaps. It would probably be safer to figure on a gross weight of 2500 lb. and a wing area of 335 sq. ft. In the design of a plane, it is generally found that the lift of the complete machine exceeds that of the wing alone by some 10%, at high angles of attack, scale effect, the fuselage and horizontal tail surfaces contributing the extra 10%. Using slots and flaps it should therefore be quite possible to secure the low gliding speed without going to an aircraft of cumbersome dimensions.

The minimum speed of 35 m.p.h. should be readily secured, since in this case the propeller slipstream increases the lift somewhat and the propeller is acting somewhat like a helicopter. British experiments both in the wind tunnel and in full flight show that as the V/nD decreases the slip stream effect on lift progressively increases. At V/nD of .6 the increase in lift was of the nature of 8% ([21]). On a machine such as analyzed here we might have to deal with a V/nD equal to $\frac{35 \times 1.467}{1600/60 \times 8.5} = .227$. It is therefore not unreasonable to suppose that the difference between 38 and 35 m.p.h. would be readily met.

The next question to decide is whether such a machine could attain the high speed of 110 m.p.h.

It is sufficient for our purpose to use such simple formulae as given by Diehl ([22])

$$V_{max} = \frac{K\,V_{min} \cdot \sqrt[3]{\eta}}{\sqrt[3]{V_{min}\,W/P}}$$

Where K has an average value of 20 while $\sqrt[3]{\eta}$ ranges from 0.88 to 0.94.

In this formula V_{min} has to be estimated with reference to maximum lift coefficient of the wing alone without the aid of slots and flaps. To take full advantage of the slot and flap, the designer will naturally take a wing which has a fairly low coefficient to start with and is efficient at high speed. Assuming maximum Ky = .003 for the basic airfoil and $\sqrt[3]{\eta}$ = .94 we find the maximum speed to be 109 m.p.h. A slight improvement in propeller design (which in a competition machine can be designed frankly for high speed) careful streamlining, the use of a low lift wing with some convex lower camber, and a well tapered plan form, should allow the 109 m.p.h. to be easily exceeded by several miles.

Preliminary calculations give an initial climb of 865 ft. per minute. The rules of the competition require that the Rate of Climb Test under "Qualifying Requirements" must be passed at the same fixed setting of the device. In such a case, the climb is likely to be considerably less because the profile drag of the open slot airfoil is greater than the profile drag of the basic airfoil. But it is hardly conceivable that a plane with the characteristics outlined would fail to achieve 400 feet a minute, even with slot open. There is no need to consider the flattest glide at 8 degrees to the horizontal. Any machine having the efficiency necessary for 110 m.p.h., will achieve this flattest glide with ease.

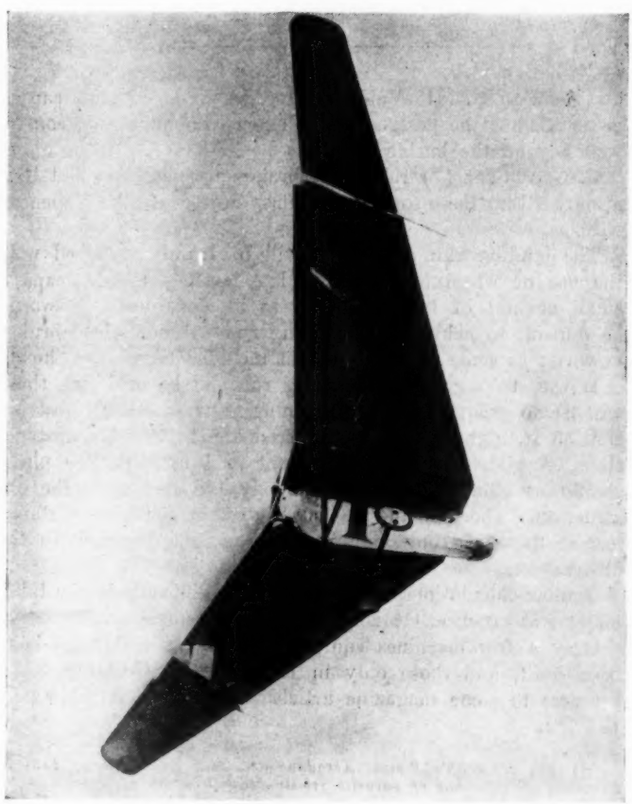


Fig. 14. The Pterodactyl in flight.

The steepest glide on the other hand has to be calculated very carefully.

Assuming the propeller efficiency to be 75% at 110 m.p.h., the thrust delivered is $\frac{200 \times 375}{110} \times \frac{75}{100} = 512$ lb. With an aspect ratio of 6, the span of the monoplane of 335 sq. ft. wing area will be 44.7 ft. and the induced drag = $\frac{125 \times W^2}{(Span)^2 \times V^2} = \frac{125 \times 2500^2}{(44.7)^2 \times 110^2} = 32.1$ lb.

The profile drag coefficient of the wing may be assumed as

([21]) *The Influence of the Airscrew on the Aircraft Characteristics of a Standard Bristol Fighter Aeroplane. By W. G. Jennings, British R & M 1083.*

([22]) *Reliable Formulae for Estimating Airplane Performance and the effects of changes in Weight and Wing Area. W. S. Diehl N.A.C.A. R. No. 173.*

.000030 giving a profile drag of .00003 × 335 × 110² = 122 lb. The parasite drag of the plane will therefore be 512 — 32.1 — 122 = 357.9 lb. The equivalent flat plate area of the parasite resistance is then $\frac{357.9}{.00327 \times (110)^2} = 9.1$ sq. ft. Which is perhaps somewhat higher than that which can be achieved in good design. At the high angles of attack of steepest glide, the parasite resistance flat plate area will be at least doubled (³³). If the wing with front slot open and flap depressed to 20° has characteristics similar to those of the A-1 airfoil (³⁴) which at 23.39° incidence has Ky of .00482 and Kx of .001170, the equation of the glide will be given by

$$\text{Tan}\theta = \frac{D}{L} = \frac{.001170 + \frac{18.2 \times .00327}{335}}{.00482} = .28$$

and $\theta = 15.8°$. It would appear that the steep glide can be achieved, but the designer must extend the power of control well beyond the burble point.

C. C. Walker (³⁵) thinks air brakes are necessary but it is apparent that these somewhat clumsy devices can be dispensed with.

The landing run of 100 ft. will be readily achieved with the use of wheel brakes, since low landing speed means a small amount of kinetic energy to be destroyed. It would be difficult to achieve this landing run without wheel brakes however, as some calculations, not included here, have shown.

If the steep glide and landing run can be achieved, there will be no great difficulty in coming to rest over an obstruction 35 ft. high, within 300 ft. from the foot of the obstruction. A glide at 16° is equivalent to 1 in 3.5. The plane should be able to touch ground only 105 feet from the obstruction. There should be ample margin for some distance lost in flattening out, and for going a foot or so above the obstruction.

Similar calculations indicate no great difficulty in the take-off and obstruction clearing tests of the competition.

Only a few machines equipped with slots and flaps have been built, and those only in England and Germany. References to some magazine articles are appended below (³⁶) (³⁷) (³⁸).

(³³) *See Monteith's Simple Aerodynamics, 2nd Edition page 145, in reference to variation of parasite resistance with angle of attack.*
(³⁴) *See Table 3.*
(³⁵) *Guggenheim Competition, comments by C. C. Walker, Flight, July 28, 1927, page 518 e.*
(³⁶) *"Slotted wings in Practice"* AVIATION, *Feb. 14, 1927.*
"The Handley Page Hamlet" Flight, Oct. 14, 1926.
"The Handley Page Hamlet" Flight, Nov. 4, 1926.
"The Handley Page Hendon" Flight, July 29, 1926.

Preliminary Calculations for a Design With Rear Flap Alone

For a monoplane design with rear flap alone, it should be possible from the data presented previously, a maximum Ky of .0045, with the flaps depressed through some 35 degrees.

With the gliding speed of 38 m.p.h. and a gross weight of 2500, the wing area required would be 370 sq. ft. If the calculations of the preceding section are repeated, and a little greater efficiency is assumed in design, it is found that the Competition requirements can still be met. There will be however, less margin in every way.

Difficulties in Mechanical and Structural Design

There are numerous difficulties, in the design of a competition machine, which it is well to face, though we believe they can all be met.

When landing on an ordinary glide, it is possible to increase the angle of attack, flatten out the path and land with minimum shock. When landing on a steep stalled glide, it is impossible to get the same effect since we are already working at the maximum lift coefficient, even if there is sufficient control to pitch the machine about the transverse axis. Therefore as Major F. M. Green points out, to take full advantage of the stalled glide, it will be necessary to provide an undercarriage with long travel. Major Green even suggests that it might be worth while giving the pilot's seat a vertical travel. In British experiments (³⁹) with slots and flaps, we find the following significant remark:—"In fact were not the rate of descent very rapid, a stalled landing would be quite feasible" of course this remark applies more to the heavily loaded Bristol Fighter.

Another departure from conventional design will be necessary in providing a landing gear which will enable the aircraft to take full advantage of the maximum lift at high incidence in landing and take-off.

The kinematics of the slot and flap movements provides quite a difficult problem.

The front slot, which must give completely satisfactory action under all service conditions, will have to be designed with great care, particularly as regards hinged supports.

Every additional aerodynamic device means besides increase in complexity, increase in weight. Lightly loaded machines are harder to design with a good structural weight percentage

(³⁷) *Technische Gegenwartsfragen in deutschen Flugzeugbau by H. Hermann Jahrbuch der Wissenschaftichten Gesellschaft fur Luftfahrt, 1925.*
(³⁸) *Albatross L 72 A, Flight, April 15, 1926, and Aeroplane, April 14, 1926.*
(³⁹) *Preliminary Report on the Fitting of Slots and Flaps and Slot-and-Aileron Control to a Bristol Fighter, by H. L. Stevens, British R & M 1088.*

The Handley Page Hamlet four-passenger cabin plane equipped with three 120 hp. Bristol Lucifer air-cooled radial engines. The open leading and trailing edge slots of the Handley Page wing are clearly visible.

than heavily loaded planes. Therefore the structural design of a competition aircraft will have to be particularly refined, an objective not primarily sought for in drafting the rules.

We have assumed that the various lift producing devices can act along the whole span of the airplane. The question of securing lateral control while using the whole of the span for increasing lift is a difficult one.

Major F. A. Bumpus ([e]) suggests that the winning machine, capable of flying at 30 m.p.h., would have a wing loading of only 4½ lb. per sq. ft. with a variable airfoil device and only 3 lb. per sq. ft. with a constant airfoil, and that with such wing loadings, the machine would be unsafe, particularly when landing in gusty air, when the varying gusts might be of the same order of magnitude as the slow speed of the airplane itself. R. J. Mitchell ([f]), another British designer voices the same view.

TABLE 4. CHARACTERISTICS OF AIRFOILS OF VERY HIGH MAXIMUM LIFT

Reference	Designation of Airfoil	Sketch of Airfoil	Maximum Camber	Maximum Ky	Minimum Kx	Maximum L/D
Ergebnisse der Aerodynamischen Versuchsanstalt zu Göttingen. Vol. 3.	Gött 461		.135	.00417	.000158	12.1
	Gött 482		.182	.00424	.000073	15.7
	Gött 579		.122	.00435	.000138	10.1
	Gött 603		.181	.00457	.000207	10.8
	Gött 552		.250	.00456	.000240	11.5
	Gött 578		.281	.00411	.000252	9.3
	Gött 576		.169	.00465	.000209	8.1
	Gött 544		.228	.00433	.000309	8.0
	Gött 553		.252	.00485	.000291	6.9
	Gött 557		.269	.00514	.000304	5.9
N.A.C.A. Rep. 244	U. S. A. 35A		.185	.00404	.000054	18.2
	U. S. A. 40		.133	.00410	.000056	16.3
Jour. Soc. Aut. Eng. March 1921	Dayton-Wright 6		.140	.00399	.000080	13.6
	Glenn Martin 2		.142	.00400	.000085	14.0

We believe that these eminent authorities are wrong in taking the extreme limits of slow speed attainable. It is really more fitting to consider the required speed on the glide of 38 m.p.h. in which case, with the use of slots and flaps a loading of 7 lb. per sq. ft., is much nearer the mark.

As Major F. M. Green ([g]) points out, this loading would surely be not too low for all practical flying purposes. We remember the Wright biplane in the early days, venturing out at Curtiss Field when more heavily loaded craft stayed on the ground because of bumpy air. A slow, stalled landing, under perfect control with the nose of the machine several degrees above the horizontal is certainly the safest when landing in dark or foggy weather, or in rough ground. If weather were somewhat gusty, the pilot would always have the option of landing with slot closed, or the flap in neutral, or both. If the weather were very gusty indeed, he might land with slot closed, flap in neutral and flying at a small angle of attack and at as high a speed as he deemed necessary.

Similar criticisms with regard to taxiing can be met with the simple statement that the slow speed gear need not be always utilized.

Commercial Value of a Prize-Winning Aircraft

Harry F. Guggenheim ([a]) has forcibly stated the position for the commercial value of a prize-winning aircraft. He has in this paper presented the performance characteristics of an aircraft winning the maximum number of points.

Maximum speed ..... 130 m.p.h.
Minimum speed in level flight ..... 30 m.p.h.
Minimum speed on the glide ..... 32 m.p.h.
Landing run of 40 ft.
Ability to land over an obstruction 35 ft. high within a distance of 150 ft. from its base.
Take-off run of 75 ft.
Ability to clear an obstruction of 35 ft. within a distance of 240 ft. from its base.

These performance characteristics speak for themselves, and coupled with the ability to glide steeply into a field, perfect control and stability and good behavior under abnormal conditions, should make a commercial aircraft par excellence.

As previously stated we do not believe that the objections raised on the score of low loading and lack of stability in bumpy air are at all valid.

Lift Increasing Devices Practical

It is impossible to believe that the cost, complexity and additional weight which use of the lift increasing devices must entail to some extent, will forever prevent their adoption on commercial airplanes. They have certainly never been given a fair trial in the United States. We believe that their non-adoption to date is due to undue conservatism on the part of designers and pilots. The airplane wheel brake offers a similar instance. In 1920 the writer, among others, suggested to the Air Mail authorities that such a brake could be readily and advantageously employed; the suggestion was rejected on the grounds of cost, complexity and additional weight. In 1926 successful adoption of the wheel brake by one or two commercial manufacturers, led rapidly to general use.

A frequent criticism of the competition machine from the commercial point of view is that its speed will be too low. There is no reason however that the 110 m.p.h. top speed should not be exceeded by several miles, and a cruising speed of 100 m.p.h. not be obtained.

Another criticism is regarding the useful load. The requirement of 5 lb. useful load per horse-power certainly does not leave much pay load. For many purposes it should be quite sufficient. Then machines such as the competition machines should have a wonderful overload capacity; their wing loading should actually be made much higher than that of the conventional commercial machine, if usual landing speeds are

([e]) *The Guggenheim Competition, comments by F. A. Bumpus, Flight, July 28, 1927, page 518 d.*

([f]) *The Guggenheim Competition, comments by R. J. Mitchell, Flight, July 28, 1927, page 518 e.*

([g]) *The Guggenheim Competition, comments by F. M. Green, Flight, July 28, 1927, page 518 e.*

([a]) *American Society of Mechanical Engineers.*

not feared. The only limitation to overloading would be in the matter of climb, and rear flaps can actually be made to give slightly better climb in certain instances by providing higher maximum values of the coefficient $\frac{Ky\ 3/2}{Kx}$.

Finally let us quote again from M. C. C. Walker's comments:—

"The production of an aeroplane which is much easier to fly and allows perhaps time and space for errors of judgement to be corrected would have the effect of greatly enlarging the circle of users. Increased safety and confidence would then result from mass-experience obtained, this being an indirect and long-range effect of making it easier to fly. The young man on the motor-bicycle is running no more risk than the old gentleman who has recently bought a car; statistics might indeed show that the motor-cycle is safer, for although it calls for much more skill than the car, it does in general, get more and a tolerable all-around degree of safety is thus attained in the use of the road."

Hill's Tailless Plane

Hill's Tailless Airplane or Pterodactyl was one of the sensations of 1926. It has been excellently described in a number of publications (44). Marco Polo writing in Flight (45) points out that many of its features correspond exactly to the requirements of the competition.

While our readers are no doubt quite familiar with the Pterodactyl, the photograph of Fig. 14, may serve to recall the salient characteristics of this craft, which may be summarized as follows:—

(a) A swept back wing, with reflexed trailing edge and with a 5° washout in incidence to the wing, so as to secure a stationary center of pressure.

(b) Controllers at the wing tips, double cambered and symmetrical in section, acting both as ailerons and elevators.

(c) Rudders in the shape of vertical surfaces, mounted above and below the extremity of the fixed wing, and "Single-acting" that is with the surfaces on one wing only moved outwards at their trailing edge to produce yawing moment.

Equipped with an air-cooled engine, estimated by Captain Hill as giving 32 hp., the main characteristics of the Pterodactyl are as follows:—

Area of main plane, 223 sq. ft.; wing span, overall 45 ft.; wing span, fixed part of wing only, 30 ft.; area of controllers, 55 sq. ft.; area of rudders, 13 sq. ft.; weight empty, 458 lb.; useful load, 200 lb.; total weight, 658 lb.; maximum speed, 70 m.p.h.; stalling speed, 25 m.p.h.

Captain Hill states the advantages of the craft (and they are thoroughly substantiated by all flight tests) to be as follows:—

"Each of the four controls performs its own function and does not interfere with any of the other controls. Variation in engine power has no effect other than an alteration of the rate of climb or glide.

"On turns, both the fore and aft rudder controls are more straightforward and simple in operation than on the normal aeroplane.

"There is no stalling point or marked division between stalled and normal flight, the pilot can 'unstall' without increasing his rate of descent.

"In general, the aeroplane is always under good control up to large incidences in the neighborhood of 45 deg."

The designer also states: "The tailless design can be built for a percentage weight smaller than the normal."

There is nothing in the design to indicate that this is so.

(44) *"The Tailless Aeroplane", by G. T. R. Hill, Aeronautical Journal, September 1926.*

(45) *"The Guggenheim Competition, Some Speculations by Marco Polo", Flight, June 23, 1927.*

La Cierva's Auto Giro (top) and Hill's Pterodactyl in the air at the 1926 Royal Air Force Display in England.

Many a light plane has been built with similar structural and useful load percentages. It seems tempting to get rid of the weight of a long fuselage. But there are unfamiliar loads to take up on the wings, overhanging controllers increasing the span beyond normal, a third wheel and structure back replacing the customary tail skid, etc. .... There is a possibility of some structural weight saving, but not a very great one.

From the point of view of aerodynamic efficiency, the wind tunnel curves are good, with a maximum L/D of about 10.6 for the complete machine but not extraordinarily good. There is no reason why a well streamlined fuselage should not actually have less resistance than the stubby nacelle. There is a slight gain apparently in the elimination of stabilizer and elevator, but stability produced by swept-back, reflexed, washed out wings is always more expensive, aerodynamically speaking, than conventional stabilization.

If we substitute in Diehl's (46) formula for speed range

$$V_{max} = \frac{K V_{min}\sqrt[3]{\gamma_i}}{\sqrt[3]{V_{min}} \cdot W/P}$$

we find K = 23.6, which is high but not extraordinarily so. The aerodynamic efficiency of a lightly loaded machine is always high because the wing area is so large relative to the equivalent parasite area. When the Pterodactyl is loaded more heavily per sq. ft., than in the present design, it is unlikely that it will have a fineness greater than a conventional airplane of similar design. Checking back to the wind tunnel curves,

(46) *Reliable Formulae for Estimating Airplane Performance and the Effects of changes in weight and wing area, by W. S. Diehl, N.A.C.A. R. No. 173.*

we also find that at the lift coefficient corresponding to 110 m.p.h. the L/D of the model is only 3.

The maximum lift coefficient as tested in the wind tunnel was only .00264. Evidently the reflexed trailing edge and the washout at the tips mean a decided loss in lift capacity. The designer of a tailless airplane will find it just as necessary as the designer of a more conventional craft to use some device for increasing maximum lift.

For the Pterodactyl, great advantages are claimed for the constant center pressure wing, and the controllers will certainly avoid the adverse yawing moments of the conventional aileron.

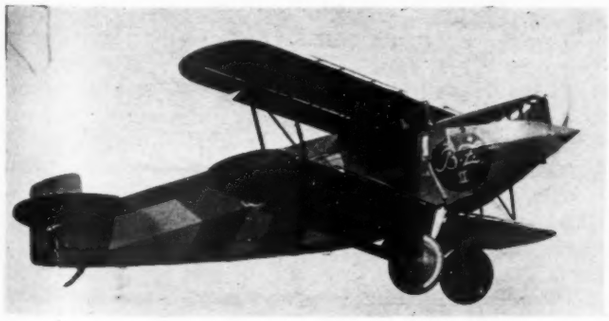
In 1916 the writer suggested that aileron might well be in the form of interplane surfaces, symmetrically double cambered and so connected to the control column as to lie in the wind at any flight attitude of the plane. The success of the controllers is perhaps a confirmation that the suggestion was a useful one.

In the design of a slot and flap machine, it would seem seriously worth considering fitting controllers at the ends of the wing, and avoiding a great many kinematic and mechanical difficulties.

Another lesson that we may learn from the Pterodactyl is increase in parasite resistance by the use of the split rudder. Captain Hill was able to glide at 45 deg. incidence by using his two rudders as brakes. But at this angle his plane would have had a considerable vertical velocity had it not been for the very light loading.

We believe that in a slot and flap machine, a sufficiently steep glide will be achieved without the use of brakes. Nevertheless the idea of brake-rudders is worth thinking over. Perhaps a more conventional craft should have two rudders, which can have their trailing or leading edges turned to each other simultaneously. Or a single rudder which can be split in two, or struts pivoting about a vertical axis (as actually used in an Italian machine).

In flight the controllers trim along the wind at angles of attack between 0 and 30°. Therefore the movement of the



The German Albatross L72A in flight. It is fitted with slots and flaps.

center of pressure is very slight. The controllers therefore carry little or no load at any time, and whether acting as elevators or ailerons they give a wide margin of control at all flight attitudes. The difficulty is that the moment slots and flaps are introduced, and utilized, the center of pressure can no longer remain constant, the controllers begin to carry load for trim, and the margin of control at high incidence is immediately reduced. It would need a great deal of wind tunnel work to produce a wing with slots and flaps, and sweepback and washout before getting a constant center of pressure with the use of these auxiliary lift producing devices. Without the use of slots and flaps however, we are quite prepared to admit that the controllers are extraordinarily efficient both in longitudinal and lateral control. The rudders placed below the wing are actually improved by the influence of the wing at high incidence. Also their effect never diminishes even when turned through a large angle, since the drag becomes effective when the lift diminishes.

We are a little dubious as to the dynamical stability available. Captain Hill states that his craft has a relatively quick period of oscillation at 40 m.p.h. and the damping seems rather less than usual. We always prefer a long tail, and a well damped airplane.

On the whole our conclusions would be that with the slots and flaps, the Pterodactyl would lose many of its present advantages, if securing others. That a more conventional craft could be made to have all its controllability. That certain ideas in its design, are however worth the most careful study.

Conclusions

Our general conclusions may be briefly summarized as follows:—

1. There should be no insuperable difficulty in designing an airplane that would meet requirements of the competition, though the utmost skill, aerodynamic, structural and mechanical, would be required.

2. In such an airplane some method of increasing the maximum lift of the airfoil will have to be provided, and some method of improving the control beyond that provided by conventional control surfaces.

3. There is no doubt that an airplane meeting the requirements of the competition would be airworthy in every way and possess a real commercial value.

4. There is no reason to believe that there is any special advantage in departing radically from the general form of the existing airplane, and following such a direction as that of Hill's Tailless airplane for example.

5. Finally the competition offers incentive to research in many phases of the art, and is certain to induce progress of the most important character.

Newly Organized Fokker Aircraft Corp. Soon to Begin Production

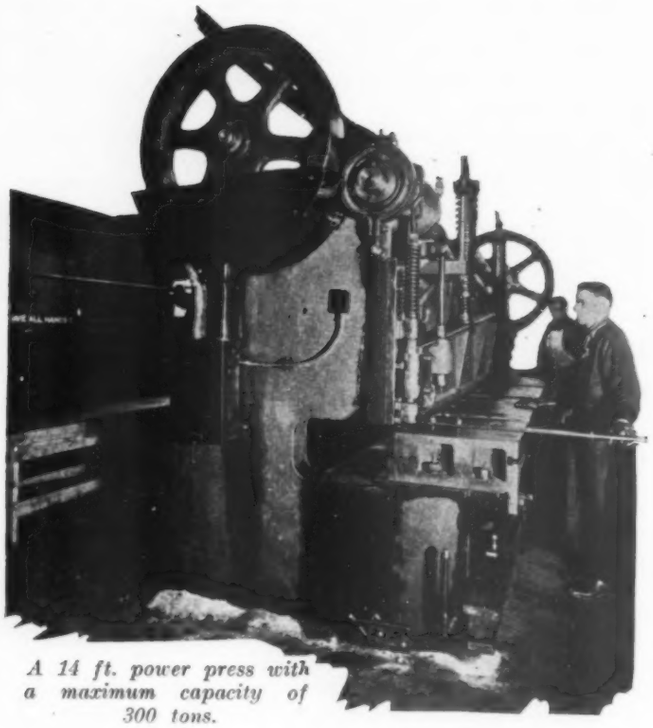
QUANTITY PRODUCTION of the Fokker Universal planes and tri-engined types is expected to commence early this spring in the new factory at Glendale, W. Va., near Wheeling, of the recently formed Fokker Aircraft Corp. of America, it is reported. Planes for both commercial and government use will be built in the large new plant which is to have more than 100,000 ft. of floor space, and testing will be done on the company's flying field which will connect with Langin Field at Moundsville near the Ohio River.

The new corporation is being financed largely by Wheeling and Ohio Valley interests in combination with the New York group which with Anthony Fokker formed the Atlantic Aircraft Corp. in 1924. The latter organization, which up to the present has been the sole manufacturers of Fokker planes in the United States, will be held as a subsidiary of the new concern. The factory at Teterboro Airport, Hasbrouck Heights, N. J., will be retained for experimental construction, service, and repair work.

Maj. Lorillard Spencer of New York is president of the Fokker Aircraft Corp., with which Anthony Fokker will be actively associated as designer and consulting engineer.

F. W. Bellamy Becomes Director of Curtiss Aeroplane & Motor Co.

F. W. BELLAMY, a member of the firm of Dominick & Dominick, has been elected a director of the Curtiss Aeroplane & Motor Co., Inc. Mr. Bellamy's election is for the purpose of giving representation to a large number of holders of stock who are not now represented on the board.



A 14 ft. power press with a maximum capacity of 300 tons.

Large Scale Airplane Production

The Glenn L. Martin Co. Producing Three Purpose Planes

THE INTENSIVE research program begun by The Glenn L. Martin Co. in May, 1924, and publicly announced ten months ago, which bore spectacular fruit in the form of the new Martin 74 air-cooled, all-metal, three-purpose plane, of which 102 have been ordered by the U. S. Navy Department, has had other interesting by-products in the shape of notable advances in airplanes manufacturing methods.

While Mr. Martin and his designing staff were busy with design problems, his production engineers were no less occupied with intensive study of the production problems involved in the radical changes in materials and construction embodied in the 74. At least one of the processes perfected as a result of this study is entirely new to aircraft manufacture.

Since the 74 is an all-metal plane, many different shapes and assembled members of duralumin are required by the design of the wings and fuselage.

As a first step in the production program $80,000 was budgeted for new special tools, of which $20,000 was invested in the set of dies on the rack shown in an accompanying photograph. Equally complete sets of jigs were also produced in order that the planes would be completely standardized and all hand-fitting eliminated.

The operation in which the dies are employed is one of the new processes developed.

Heat Treatment Electrically Controlled

Incoming sheets of duralumin are first given a heat treatment in a special chemical bath at 940 deg., electrically controlled, and are then quenched in water in the second tank.

On emerging from this treatment they are warped and wavy, having somewhat the general appearance, to a layman's eyes, of a starched collar which has been dampened and then dried.

At this stage in the process the "aging" which is necessary to complete the internal change set in motion by the heat treatment is not complete, so the treated sheets are immediately run through one of the two roll-levelling machines which are waiting close by the tanks. They come out of this "ironing", which is not an ironing in any sense because no pressure is applied by the rolls, smooth and ready for forming under the dies. The sheets are still "soft" and can be bent by hand and held as bent.

The "aging" period is one hour and a half; therefore, before that time has elapsed the sheets are sent to the 14 ft. brake and die-formed as needed. At the end of 90 min. from the time it leaves the first heat-treating bath the metal is "set" and resists any distortion, so that the die-formed shapes are then permanent.

"Eureka" Section Developed by Martin Engineers

Another especially interesting product of this process is the shapes which go to make the assembly known as the "Eureka" section, another achievement of Martin designers.

Previous to the invention of the Eureka section it was believed and contended that no shape could have a strength-weight factor equal to that of a tube of identical material. The Eureka section accomplishes this and, in addition, has assembly advantages and self-draining qualities which make it far superior to the tube in aircraft manufacture. Just what the Eureka section is is shown by an accompanying photograph—four shallow, trough-shaped members held apart by spacers and riveted together. Exhaustive tests by the government have completely established every claim originally made for the Eureka section.

Produced on Special Jigs

Eureka sections are produced on specially designed jigs, also designed and manufactured in the Martin plant, to facilitate quantity production of this basic part of the Martin 74.

In addition to the equipment described above, production of the 74 has made necessary the purchase of considerable other equipment in the form of electrically controlled and operated furnaces, boring machines and testing devices.

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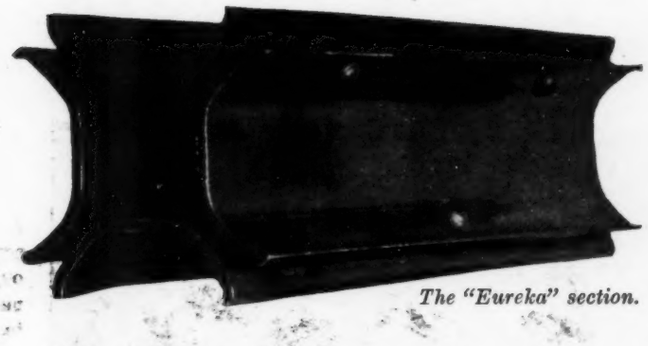
The Martin "Eureka" Section



The "Eureka" section.

After an Extensive Research Program the Glenn L. Martin Co. Has Developed a Very Efficient Structural Section

By LESSITER C. MILBURN
Chief Engineer, The Glenn L. Martin Co.

IT WAS apparent to the engineers of the Glenn L. Martin Co. a few years ago that the type of construction formerly used for the structural framework of airplanes contained inherent faults which would ultimately cause them to be discarded in the march of progress toward excellency of design and efficiency of production. "Stick and wire" had already passed away. The larger producers of welded steel tubular construction were beginning to seriously doubt its adaptability to large volume, high speed fabrication. The uncertainties of inspection, the difficulties of maintaining accurate interchangeability, the highly specialized labor required, the costly interruption caused by spoilage of any part of an important assembly were recognized as permanent obstacles to the smooth flow of work so necessary for large scale production. Semi-monocoque fuselage or wing construction of wood or metal appeared likewise to have a fundamental fault in that the majority of labor-hours per airplane is required for the bulky final assemblies, resulting in relatively low production per unit floor space.

The faults of existing types of construction appeared most prominently in the making of joints and fastenings, and the joint was selected as the key to improvement. It was determined early in 1924 to develop a structural shape, which at least equaled tubing in strength-weight characteristics, while at the same time affording opportunity for joint connections

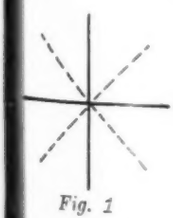


Fig. 1

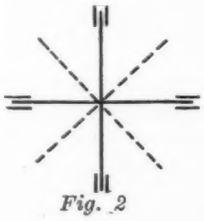


Fig. 2

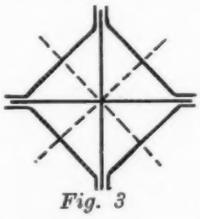


Fig. 3

that would be efficient from the viewpoint of design, and well adapted to mass production.

As the investigation was to be the basis for future development, no attempt was made to quickly re-tailor existing construction. On the contrary, it was decided to go at once to fundamentals.

It is important to notice when airplanes are built of aluminum alloy, as the majority of modern types are, that the basic material is important. Considerable difficulty has always been experienced by aluminum producers in manufacturing tubing and extruded shapes from strong alloys, due to the inherent difficulties of the fabricating processes. Both processes are limited to a certain minimum thickness of material. Extruded shapes are difficult to make less than one-eighth inch thick, while tubing of less than about .040 in. requires considerable additional processing in manufacture, and bears a high spoilage loss. From a commercial viewpoint, these faults are reflected in the cost of the fabricated material to the plane builder. From the military standpoint, however, these difficulties are not only costly, but likewise dangerous, for the reason that a sudden necessity for tremendous expansion of the supply of tubing or extruded shapes would find requirements long unfulfilled, with possibly disastrous results to an extensive war aviation program.

Members Capable of Rapid Assembly

Three fundamentals were recognized. The basic material must be available in quantity at low cost. The individual members must have their material distributed to the best advantage. All members must be capable of rapid and efficient assembly and attachment.

The application of these principles in detail will illustrate the process of development. A specific instance is the Martin structural shape called "Eureka" which is now being used for members whose critical stress is compression.

Routine study and testing of angles, channels, T and I sections soon developed the fact that such sections, taken individually, would not stand comparison on the vital consideration of weight. This is due to the non-uniform distribution of the material about the section centroid, and, as a direct result, members of such cross-sections fail before the full capabilities of the material have been reached.

To satisfy technical and structural requirements, the section must be symmetrical about both axis, and it must be capable of ready attachment along two lines, at right angles to each other, and, if possible, also two diagonal lines, as indicated in Fig. 1.

The next developing step was reached by consideration of the simplest possible type of attachment fitting, which is the flat plate. The fastening, to be capable of determinate analy-

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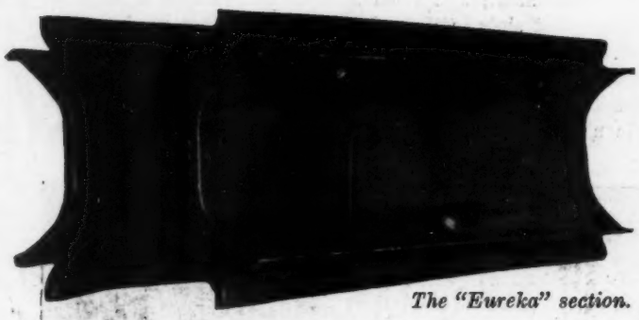

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Chief Engineer, The Glenn L. Martin Co.

IT WAS apparent to the engineers of the Glenn L. Martin Co. a few years ago that the type of construction formerly used for the structural framework of airplanes contained inherent faults which would ultimately cause them to be discarded in the march of progress toward excellency of design and efficiency of production. "Stick and wire" had already passed away. The larger producers of welded steel tubular construction were beginning to seriously doubt its adaptability to large volume, high speed fabrication. The uncertainties of inspection, the difficulties of maintaining accurate interchangeability, the highly specialized labor required, the costly interruption caused by spoilage of any part of an important assembly were recognized as permanent obstacles to the smooth flow of work so necessary for large scale production. Semi-monocoque fuselage or wing construction of wood or metal appeared likewise to have a fundamental fault in that the majority of labor-hours per airplane is required for the bulky final assemblies, resulting in relatively low production per unit floor space.

The faults of existing types of construction appeared most prominently in the making of joints and fastenings, and the joint was selected as the key to improvement. It was determined early in 1924 to develop a structural shape, which at least equaled tubing in strength-weight characteristics, while at the same time affording opportunity for joint connections

Fig. 1

Fig. 2

Fig. 3

that would be efficient from the viewpoint of design, and well adapted to mass production.

As the investigation was to be the basis for future development, no attempt was made to quickly re-tailor existing construction. On the contrary, it was decided to go at once to fundamentals.

It is important to notice when airplanes are built of aluminum alloy, as the majority of modern types are, that the basic material is important. Considerable difficulty has always been experienced by aluminum producers in manufacturing tubing and extruded shapes from strong alloys, due to the inherent difficulties of the fabricating processes. Both processes are limited to a certain minimum thickness of material. Extruded shapes are difficult to make less than one-eighth inch thick, while tubing of less than about .040 in. requires considerable additional processing in manufacture, and bears a high spoilage loss. From a commercial viewpoint, these faults are reflected in the cost of the fabricated material to the plane builder. From the military standpoint, however, these difficulties are not only costly, but likewise dangerous, for the reason that a sudden necessity for tremendous expansion of the supply of tubing or extruded shapes would find requirements long unfulfilled, with possibly disastrous results to an extensive war aviation program.

Members Capable of Rapid Assembly

Three fundamentals were recognized. The basic material must be available in quantity at low cost. The individual members must have their material distributed to the best advantage. All members must be capable of rapid and efficient assembly and attachment.

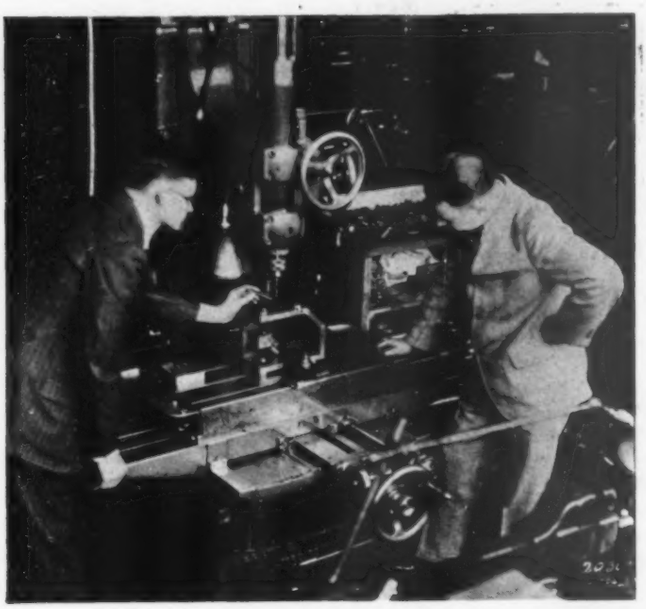
The application of these principles in detail will illustrate the process of development. A specific instance is the Martin structural shape called "Eureka" which is now being used for members whose critical stress is compression.

Routine study and testing of angles, channels, T and I sections soon developed the fact that such sections, taken individually, would not stand comparison on the vital consideration of weight. This is due to the non-uniform distribution of the material about the section centroid, and, as a direct result, members of such cross-sections fail before the full capabilities of the material have been reached.

To satisfy technical and structural requirements, the section must be symmetrical about both axis, and it must be capable of ready attachment along two lines, at right angles to each other, and, if possible, also two diagonal lines, as indicated in Fig. 1.

The next developing step was reached by consideration of the simplest possible type of attachment fitting, which is the flat plate. The fastening, to be capable of determinate analy-

sis and rapid final assembly, should be made with rivets or bolts. A flat plate, fastened in a slot is the simplest and most secure attachment, and from such considerations it was determined that slots must be incorporated, either in the structural shape, or in the fittings at the joints. It appeared that weight could be conserved by putting the slot in the structural member because no increase in cross-section area is involved, while a slot in the fittings would result in duplication, and



At the Martin factory there are machine tools of fine precision for making jigs and fixtures for production use.

in many cases complication. To maintain the essential element of symmetry, the slots were arranged as indicated in Fig. 2, distributed about the longitudinal axis of the member. Providing flat surfaces, through which additional fastenings could be passed, was readily accomplished, as shown in Fig. 3.

Having proceeded thus far, it was apparent that combinations of certain channel elements would accomplish all purposes desired. Having obtained the correct basic structural shape, the most efficient proportions and final refinements were gradually evolved by routine research in the testing laboratory.

The development of structural shapes for members in all parts of the airplane has proceeded along the same line of reasoning.

Reverted to Fundamentals

A great many of the troubles encountered with previous types of construction were cumulative, and came about through haphazard development, unguided by thought of future requirements. By reverting to fundamentals it has been found possible to produce a variety of structural shapes, which are free from inherent faults, and which give excellent promise of further constructive development. The benefits resulting from such a plan of investigation are typified by the advantages of the Eureka shape described above, over previous types. When it is used in a frame structure, such as a fuselage, the frame-work is noticeably lighter than tubing, either steel or aluminum alloy. An important difference is in the weight of fittings and attachments. In the specific case of a 7500 lb. airplane, the weight of the uncovered fuselage structure was 38 per cent. lighter than a structure of the same dimensions made of alloy steel tubing.

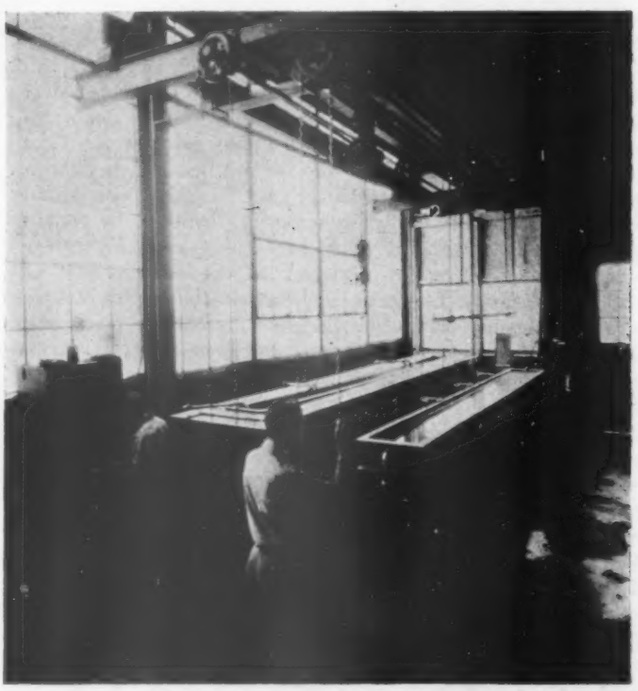
There is no certainty as to the strength of joints or members. Formed shapes, made from sheet material do not undergo heating processes in fabrication, nor torture in process of raw stock manufacture, and, therefore, the material is of a much more reliable and uniform consistency, and in better working condition.

A structural shape, such as the Eureka is readily and conclusively inspected at any time during manufacture, and any time after going into service, in contrast with tubes, whose interior surfaces are always an unknown quantity.

A highly important engineering consideration in aircraft structures, especially of light alloys, is corrosion, and particular care is taken by Martin engineers to carefully preserve adaptability to protective coatings whenever structural shapes are being developed. In the case of the shape described above, each channel element is completely and thoroughly weatherproofed before being joined to its fellow elements to form the completed member, insuring maximum protection.

Simple and Light Connections Desired

The simplicity and lightness of connections which contribute so materially to the structural efficiency, is likewise a great convenience to the designing engineer, both in the arrangement of primary structure, and of minor braces, brackets, joints, and sundry supports for mounting equipment, etc. The adaptability of fundamentally correct shapes is, however, of even greater importance from the viewpoint of maintenance,



The Long heat treating furnace at the Martin factory. It is fitted with electrically recording potentiometers.

repair, and alterations desired during the service life of the airplane. It vitally concerns the effectiveness of planes in war, and the cost of commercial operations.

Closely interwoven with purely technical considerations are many important requirements for economical construction. The coming struggle for efficiency of production has already forecast the lines of thought which must be followed. Briefly the raw materials must be available in ample quantities at moderate cost. Structural details must be readily adaptable

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Pratt *and* Whitney Engines *In* Boeing Mail Service

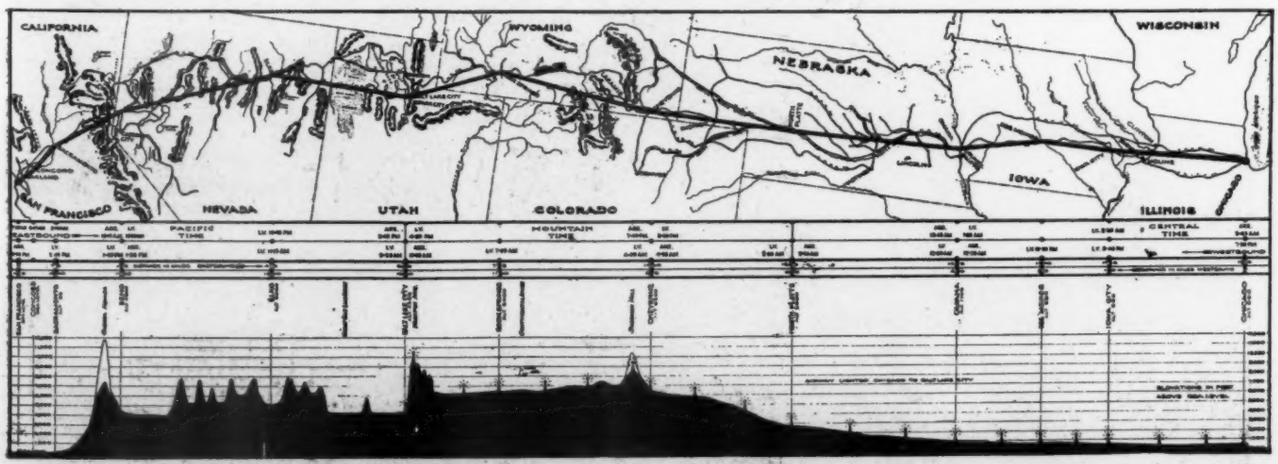
Wasp Engines Used in Boeing Mail Planes on Chicago-San Francisco Route

BOEING AIR Transport, Inc., of Seattle, Wash., completed on Dec. 31, 1927, the first six months of its operation of trans-continental air mail from Chicago, Ill., to San Francisco, Calif. Operation began last July using 24 specially built Boeing mail planes powered with Pratt & Whitney Wasp engines and during this six months of service, over perhaps the roughest terrain of any airway in the world, the engines and planes have stood up remarkably well. In this period there were only five mechanical engine failures all of which were essentially minor in nature. While they resulted in delays, there was no damage to the planes, passengers or pilots, and only slight damage to the engines, so that almost within a few hours all were again in service. This is a record of 800,000 mi. of difficult commercial flying in the hands of a number of different pilots.

A Wasp engined Boeing mail plane of the type on the Chicago to San Francisco air mail route.

When operating over this route the planes and engines are subjected to wide extremes of flying conditions. The planes are operated at altitudes from sea level to approximately 6,400 ft. over flat prairie and over mountains that sometimes force the planes as high as 15,000 ft. Ground temperatures vary from 45 deg. in winter to as high as 130 deg. in summer. Part of the route is flown at night and over some of the worst portions the heaviest loads are carried. It might be well at this point to quote part of a description of this route by Charles N. Monteith, chief engineer of the Boeing Airplane Co., builder of the planes used over the route.

"Eastbound, leaving San Francisco, the short trip to Sacramento can be made at any altitude, depending upon atmospheric conditions. Within 100 mi. of Sacramento, the plane must clear a minimum altitude of 8,000 ft. which is the elevation of the pass in the Sierra Nevada Mountains. If this pass is obstructed by clouds, as is often the case, it is necessary to ascend to an altitude of 13,000 ft., or even 15,000 ft., to be certain of clearing the peaks of the range. On the other side of this range, the airplane drops into Reno, Nev., at an altitude of 4500 ft. The next stop is Elko, Nev., at an elevation of 5060 ft. Between these two places are ranges of mountains with maximum elevations of 8000 to 10,000 ft., although, by following the passes, an altitude of 7,000 to 8,000 ft. is safe for flying. East from Elko, there are few ranges, after which the line crosses Salt Lake Desert and enters Salt Lake City at an elevation of 4,400 ft. Into



Profile and map of the air mail route between Chicago and San Francisco. Within 100 mi. of Sacramento, Calif., the air mail plane must clear a minimum altitude of 8000 ft. and taking off at an altitude of 4,400 ft. at Cheyenne, Wyo., it must reach 10,000 ft. within 40 mi.

Salt Lake City come also two feeder lines, the Western Air Express from Los Angeles and the Varney line from Pasco, Wash., serving the Northwest.

"Out of Salt Lake City the load is almost the heaviest on the entire line. The load carried eastward out of Cheyenne usually is a few pounds heavier. Taking off at an altitude of 4,400 ft., the plane must attain an altitude of 10,000 ft. in a distance of about 40 mi. to clear the Wasatch Range. The next stop, at Rock Springs, Wyo., is at an altitude of 6,400 ft. and is the highest regular stop. The emergency field at Rawlins, Wyo., is higher, having an elevation of approximately 8,000 ft. Leaving Rock Springs, it is necessary to fly at about 7,000 or 8,000 ft. until within 100 mi. of Cheyenne, Wyo., when it is necessary to go to 10,000 ft. to clear the Laramie Mountains at Sherman Pass. Cheyenne lies at an altitude of 6,200 ft. From Cheyenne eastward, the route is over country that is substantially flat, the elevation decreasing to 2800 ft., at North Platte, Neb., 1100 ft. at Omaha, 660 ft. at Iowa City, and 600 ft. at Chicago."

This is part of the transcontinental system and represents about two-thirds of the total distance from New York to San Francisco. The accompanying illustration strikingly indicates the character of the country over which this flight is made, both ways daily. It is pointed out that the mail plane leaves Chicago at 7:50 in the evening and flies through the night across Illinois and Iowa, arriving at Omaha, Neb., at 4:30 the following morning; then across Nebraska and Wyoming, arriving in Salt Lake City, Utah, at 10:00 A.M. The last leg in the journey crosses Utah and Nevada, the plane arriving in San Francisco at 4:50 P.M.

28 Wasp Engines Used

The planes used over the route are Boeing mail planes, which were described in detail in the July 4, 1927 issue of AVIATION, are conventional biplanes with wood wings and steel fuselage covered with fabric. For the 24 planes which were put into service 28 engines were used, four of which were extras to permit periodical overhauling and inspection. The Wasp engine is called a 400 hp. type though the Navy rates it at 425 hp. at 1900 r.p.m. using domestic aviation gasoline. To the engineer it is of interest that this rating corresponds to a mean effective pressure of 132 lb. per sq. in. During the final three months of 1927 the mail loads increased to such an extent that the engines on the Eastern Division operated at about 85 per cent. of full throttle at all times.

Certain engines approached 300 hr. in this difficult service before overhauling. It may be stated here that inspection or overhaul of engines was intended to begin at 100 to 150 hr. so that all engines might receive some attention before the last ones to be looked at had reached the point of exceeding 300 hr. Experience to date indicates that the average Wasp engine in difficult service should reach 300 hr. with only routine inspection and adjustment. At this point a top overhaul and complete inspection is advisable. It is an interesting fact that some of the engines are now approaching the period of 200 additional hours of operation following their first inspection or overhaul.

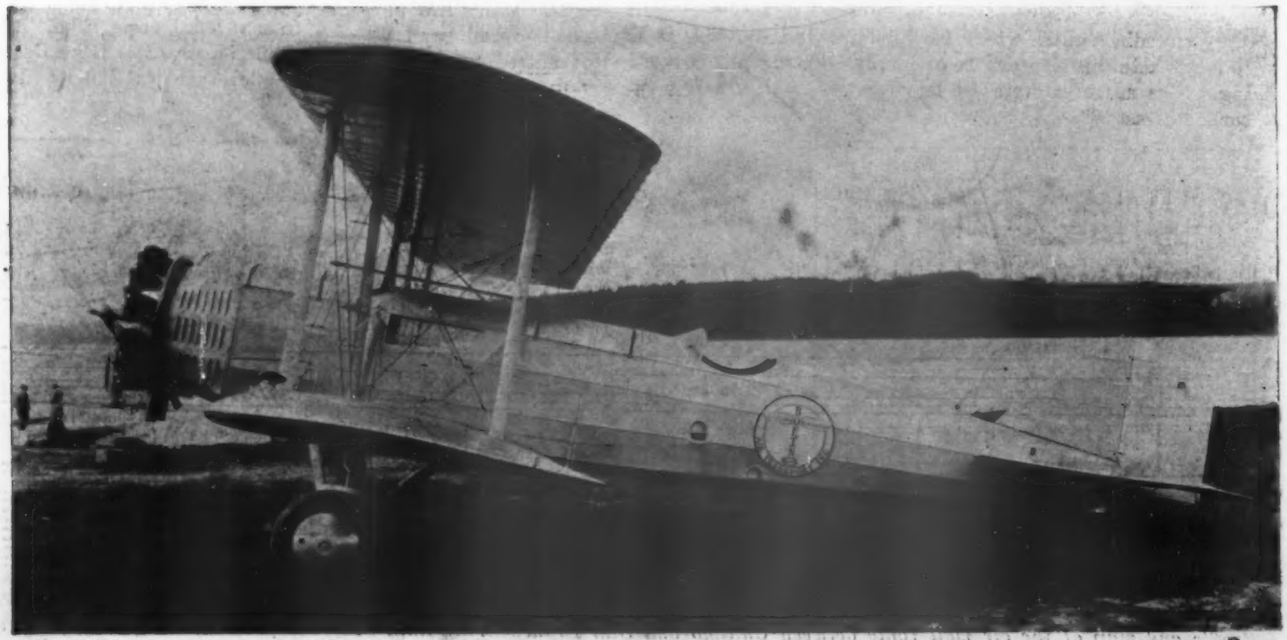
Improvements on the Engines

Of the total of five mechanical failures, two were the oil pump shaft, one a cam and two breakage of minor parts in the valve gear. It is fair to point out that in addition to the above there were four instances of scored pistons. These are not classed as mechanical failures as they were clearly caused by lack of engine temperature control, two instances occurring in the very early summer, two in the first severely cold winter weather. Temperature control and operation during the extremely cold weather is now well in hand through the employment of cowling with shutter control and the addition of the new Pratt and Whitney hot spot heater for the induction system.

A summary of the six months' operation from July 1, 1927, to Dec. 31, 1927, discloses the following interesting statistics:

Total mileage flown	815,256
Total hours flown	8,282
Total pounds mail load	298,372
Total pounds express load	8,000
Total passenger miles	363,727

(*Continued on page* 337)



A Boeing mail plane powered with a Pratt and Whitney Wasp engine. Twenty-four planes of this type were built for service between San Francisco and Chicago.

The "Command-Aire"

A Three Place Open Cockpit Biplane Now Being Produced by the Arkansas Aircraft Company

ARKANSAS AIRCRAFT Co. of Little Rock, Ark., has announced that it is in quantity production on the first model of a series of different type planes to be built during 1928. The trade name of all the planes produced by the company will be "Command-Aire". Albert Voellmecke, formerly with the Ernst Heinkel Airplane Works, Warnemuende, Germany, and now chief engineer for the Arkansas Aircraft Co., is the designer of this series of planes.

This first model (Type 3C-3) is a three place open cockpit biplane powered with a Curtiss OX5, though engines of higher power may be used. The Command-Aire has the appearance of having a very long fuselage as the cowling from the top of the radiator, which is in front of the engine, is continued back to the tail interrupted only by the openings for the two cockpits. The wing structure is of the single bay design with the center section struts spreading outward. As there are no wires or members crossing above the fuselage the pilot has excellent vision forward. This strut arrangement consists of the usual N struts supporting an exceptionally wide center section, with the N strut reinforced by an addition member or compression strut from the top wing fitting to the landing gear support at the bottom of the fuselage. Streamline wire bracing is used across the bay while there is nothing between the center section supports. The outboard interplane struts are of the usual N type. This manner of bracing with blunt nose and square radiator top gives the plane the appearance of very sturdy construction.

Landing Gear Has 7 Ft. 3 In. Tread

The landing gear, which has a fairly wide tread, tends to accentuate this appearance of sturdy construction. According to the manufacturers the landing gear is designed to absorb at least 85 per cent. of the original shock instead of part of the load being carried to the fuselage. The landing gear is of the divided axle type with a single shock absorber unit having rubber chord in tension between the center members. The fuselage is quite long and with a trend of 7 ft. 3 in. between the wheels there is little tendency to ground loop.

Fuselage Has Straight Sections

The fuselage, like the rest of the plane, is built up of many straight sections lending itself to efficient production. According to the designer the fuselage shape is very efficient reducing the resistance to a minimum. It is claimed that the fuselage is so shaped that the propeller slipstream clings to the fuselage increasing the efficiency of the tail surfaces. The frame of the fuselage is of chrome molybdenum steel tubing welded in place with no wire bracing. A fire wall consisting of a layer of asbestos between two sheets of aluminum separates the engine from the cockpits. The cockpits are very roomy though their size does seem to effect the external shape of the fuselage. Both cockpits are finished in high grade upholstering colored to match the external finish of the plane. The floor is of reinforced aluminum and is fireproof. The seat in the rear cockpit is very wide, extending the entire width of the fuselage, giving the pilot considerable freedom. This is extremely restful when making long flights. A locker for light tools and clothing is provided. The instrument panel is mounted on a steel tube bracing that prevents the instruments from vibrating and also serves as a substantial brace for the top cowling between the two cockpits.

The wings are of conventional design, both being of the same overall span with semicircular tips. The ailerons are of mitred type set in an appreciable distance from the tip. Unlike the wing the ailerons are of metal having a welded

(*Continued on page* 328)

The Arkansas Aircraft Co. Command-Aire powered with a Curtiss OX-5 engine.

MANUFACTURERS' SPECIFICATIONS ON AMERICAN COMMERCIAL

THE TABLE BELOW IS BELIEVED TO BE ACCURATE BUT AVIATION

MANUFACTURERS	Designation	Price of plane at factory	Type	No. of seats	Make of engine	Make of propeller	Span	Wing Area	Length overall	Height Overall	Weight empty, with water if water cooled engine is used	Pay load	Disposable load	Normal gross weight loaded
Advance Aircraft Co.	Waco 10	$2,385	OB	3	OX5	Hm, Hz, SS	30′ 8″	272	23′ 3″	9′ 5″	1199	800	800	1860
Alexander Aircraft Corp.	Eaglerock	$2,750	OB	3	OX5		36′ 3″	330	24′ 11½″	9′ 11″	1380		830	2230
Alexander Aircraft Corp.	Eaglerock	$2,750	OB	3	OX5		38′	360	24′ 11½″	9′ 11″	1400		850	2230
American Eagle Aircraft Co.		$2,450	OB	3	OX5	Hm, Hz	30′	300	24′ 6″		1227	840	830	2057
Atlantic Aircraft Corp	F-7	$40,000	CM	10-12	3-J5	Hm	63′ 3″	630	49′ 2″	12′ 9″	5370	2100	3690	9060
Atlantic Aircraft Corp.	Universal	$14,200	CM	5-7	J5	Hm, Hz	47′ 9″	341	38	8′ 9″	2100	1200	1900	4000
Atlantic Aircraft Corp.	Univ.-Sea.	$16,650	CMW	5-7	J-5	Hm, Hz	47′ 9″	341	35′ 10″		2406	908	1594	4000
Atlantic Aircraft Corp.	Wasp-Univ.		CM	5-7	P&Ww	SS	47′ 9″	341	36′		2500	750	1700	4200
Atlantic Aircraft Corp.	Super-Univ-	$19,340	CM	5-7	P&Ww	SS	52′ 9″	380	36′	8′ 9″	2750	1030	2000	4750
Atlantic Aircraft Corp.	Super-Univ-	$22,450	CMW	5-7	P&Ww	SS	52′ 9″	380	38′ 9″		3100	1000	1900	5050
Bach Aircraft Co.	Air Yacht		CM	9	2-K J5		52′	412	36.1′		2650			5500
Bach Aircraft Co.	C-S-I		CB	3	SR		25′ 6″	220	20′ 4′				825	
Bellanca Aircraft Corp.	CH		CM	6	J5	Hz	46′ 7″	273	24′ 9″	8′ 6″	1850		1850	3700
Breese Aircraft Co.			CM		J5		41′	260	27′	10′ 6″	1550		1000	2550
Bird Wing Commr. Airplane Co.	No. 6	$2,450	OB	3	OX5	Hz	31′ 4″	303.5	23′ 6″	8′ 7″	1267	500	1000	2285
Boeing Airplane Co.	40A		SB	1-3-5	P&Ww	HmM	44′ 2″	545	33′ 3″	11′ 7″	3031	1600	2469	5500
Brown-Mercury Aircraft Corp.		$9,800	OM	3	3-A6		41′ 6″	260	25′		1450	600		
Buhl Aircraft Co.	CA-5	$12,500	CB	5	J5	SS	43′	320	28	14′	2072	100	1628	3700
Central States Aero Co.	Monocoupe	$2,375	CM	2	AC		30′	150	20	6′ 3″	650			
Crawford M. & A. Mfg. Co.	A1	$1,500	OM	2	LR	Own	30′	150	17′ 9″	8′	950		450	1400
E. M. Laird Airplant Corp.	Commercial		OB	3	J5	SS	34′-30′	300	23′ 6″	9′ 3″	1550	800		
E. M. Laird Airplane Co.			OB	3	OX5	Hz	34′-30′	300	23′ 6″	9′ 3″	1350	300		
E. M. Laird Airplane Co.			OB	3	C6	Hz	34′-30′	300	23′ 6″	9′ 3″	1500	500		
G. Elias & Bros.	M-1	$7,500	OB	1	L12	CR	40′	497	28′	12′	2857	1200	2010	4867
G. Elias & Bros.	Airmobile	$7,500	OB	3	L12	CR	40′	435	28′	11′ 3″	2759	420	1290	4049
Fairchild Airplane Mfg. Co.	FC-2W		CM	5	P&Ww	SS	50′	332	30′ 11″	9′	2418	970	2182	4600
Fairchild Airplane Mfg. Co.	FC-2W		CMW	5	P&Ww	SS	50′	332	33′ 4″	12′	2770	1130	2380	5150
Fairchild Airplane Mfg. Co.	FC-2 land		CM	5	J5	CR	44′	290	30′ 11″	9′	2150	845	1500	3650
Fairchild Airplane Mfg. Co.	FC-2 sea		CMW	5	J5	CR	44′	290	32′ 5″	11′ 5″	2412	833	1488	3900
Driggs Aircraft Corp.	Dart II	$1,750	OB	2	A3	Hz	28′	140	19′ 6″	6′	400		380	780
Hamilton Metalplane Co.	Landplane		CM	6	J5	Hm	48′	300	34′ 5″	8′ 1″	1860		2000	3850
Hamilton Metalplane Co.	Seaplane		CMW	6	J5	Hm	47′	300	34′ 10″	9′ 1″	2150		160	3750
Heath Airplane Co.	Parasol	$695	OM	1	H	own	23′	94	16′ 9″	5′ 11″	290		225	515
International Aircraft Corp.	F-17	$2,750*	OB	3	OX5	Hm	35′	325	25	9′ 6″	1300	400	821	2121
International Aircraft Corp.	F-17	$2,900*	OB	4	Hisso		35′	325	25		1400	400	1139	2539
International Aircraft Corp.	F-17	$2,900*	OB	4	J5	SS	35′	325	25		1350	400	1239	2589
International Aircraft Corp.	F-18	$2,250*	OB	4	J5	SS	37′	360	27′ 6″	10′ 6″	1550	1000	1843	3393
Ireland Aircraft, Inc.	Neptune	$14,600	OBA	5	J5	CR	40	350	31′ 6″	9′	2000	800	1358	3358
Irwin Aircraft Co.	M-T-2	$1,165	OB	1	I79	own	30′	105	18′ 6″	5′ 9″	250	100	150	525
Irwin Aircraft Co.	44	$1,950	OB	3	2-I79	own	27	180	18	6′ 9″	370	400	200	975
Irwin Aircraft Co.	C-C-1	$1,350	OB	1	I79	own	21′ 6″	111	14	5′ 9″	250	150	150	550
Keystone Aircraft Corp.	Pronto		OB	3	J5		39′ 11″	365	26′ 9″		1975		1310	3285
Keystone Aircraft Corp.	Pathfinder		CB	12	3-J5		66′ 6″	1150	40′ 4″		6536	1900	4485	10841
Kinner A. & M. Co.	Airster	$3,350	OB	2-3	KE3	S	28′ 6″	236	21′ 3″	8′ 5″	850	330	700	1500
Kreider-Reisner Aircraft, Inc.	Challenger		OB	3	OX5	Hz, Hm	30′ 1″	296	23′ 9″	9′ 4″	1189	412	811	2000
Lincoln Aircraft Co.	L'ncln-Page		OB	3	OX5		32′	300			1200	450	1000	2200
Lockheed Aircraft Co.	Vega	$12,500	CM	5-7	J5	SS or We	41′	275	27′ 6″	8′ 6″	1650	1000	1550	3200
Lockheed Aircraft Co.	Air Exp.	$15,500	CM	5-7	P&Ww	SS	41′	275	27′ 6″	8′ 6″	1850	1000	1845	3645
Lockheed Aircraft Co.	Air Exp.	$17,500	CMW	5-7	P&Ww	SS	41′	260	31′ 6″	9′	1950			3750
B. F. Mahoney Aircraft Corp.	Ryan B1	$9,700	CM	5	J5	HmW	42′	290	27′ 9″	9′ 10″	1800		1300	3300
Mohawk Aircraft Corp.	Pinto	$2,875	OM	2	AC	Hz	30′ 6″	124	20′ 2″	6′ 3″	700		500	1200
National Airways System, Inc.	Air King	$2,395	OB	3	OX5	Hz	31′	310	25′ 5″	9′	1290		800	2090
Pheasant Aircraft Co., Inc.	H-10	$2,375	OB	3	OX5	Hz	32′ 6″	283.2	23′ 6″	9′	1297	600	785	2082
Pitcairn Aviation, Inc.	PA-5	$10,000	OB	1-3	J5	SS	33′	252	22′ 10″	8′ 10″	1612	600	770	2513
Pitcairn Aviation, Inc.	PA-4		OB	3	OX5	Hz	30′	226	21′ 10″	8′ 7″	1165		785	1950
Prudden-San Diego Airplant Co.			CM	7	3-RS7		52′	350	35′	10′	2250		1500	3850
Richmond Airways, Inc.	Sea Hawk		OMF	5	C6		46′	317	28′		1700		1000	2700
Sikorsky Mfg. Co.	S-36		OBA	8	2-J5		72′	668	34″	12′	4600		3000	7600
Sikorsky Mfg. Co.	S-37		CB	18	2P&Wh		100′	1049	45′ 6″	16′ 3″	8000	4060	7000	15000
Stearman Aircraft Co.	C-2-A	$3,575	OB	3	OX5	Hm, Hz	35′-28′	296	24′	9′	1336	320	804	2140
Stearman Aircraft Co.	C-2-B	$8,730	OB	3	J5	Hm, CR	35′-28′	296	23	9′	1438	400	962	2400
Stinson Aircraft Corp.	SB-1	$11,000	CB	5	J5	SS	35′ 10″	354	28′ 10″	10′ 3″	1810		1470	3280
Stinson Aircraft Corp.	SM-1	$12,500	CM	6	J5	SS	45′ 10″	292	32′	9′	1970		1515	3485
Stout Metal Airplane Co.	4 AT		CM	12	3-J5	SS	74′	785	49′ 10″	12′ 8″	6200		3800	10000
Swallow Airplane Mfg. Co.	Commercial		OB	3	OX5		32′	300	24′	8′ 6″	1300		950	2250
Thunderbird Aircraft, Inc.			OB	3	OX5	CR	33	300	25′ 6″		1300			
Travel Air Mfg. Co.	2000	$2,950	OB	3	OX5	HmHz	34′ 8″	296	24′ 2″	8′ 9″	1350	350	750	2100
Travel Air Mfg. Co.	4000	$9,100	OB	3	J5	Hm	34′ 8″	296	28′ 6″	8′ 9″	1400	600	1000	2400
Travel Air Mfg. Co.	5000	$12,000	CM	5	J5	SS, Hm	50′ 5″	308	30′ 5″	8′ 9″	2160	750	1440	3600
Whites Aircraft	Hum. Bird	$2,150	OB	3	OX5	Hz	33′ 1½	318	23′ 6″	8′ 3″	1050	450	850	1900
Western Airplane Corp.	King Bird	$2,500	OB	3	OX5	Hz	35′	320	25′ 4″	9′	1200	600	800	2000
Zenith Aircraft Corp.	Albatross		CM	14	3-RS9	Story	90′	1032	50′	12′ 6″	4000			

TYPE: All are land planes unless stated otherwise.

C—Closed
O—Open
S—Semi-closed
M—Monoplane
B—Biplane
A—Amphibian
W—Seaplane
F—Flying boat

ENGINE: One engine unless stated in italics.

A3—Anzani
OX5—Curtiss
AC—Detroit Air Cat
H—Henderson
I79—Irwin
LR—LeRhone
W—Waterman
K—Kinner
L—Liberty
P&Wh—Pratt & Whitney Hornet
P&Ww—Pratt & Whitney Wasp
J5—Wright Whirlwind
RS—Ryan Siemens
C6—Curtiss
*—Price without engine

PROPELLER:

Hm—Hamilton
Hz—Hartzell
SS—Standard Steel
CR—Curtiss Reed
S—Story
We—Westinghouse
W—Wood
M—Metal

This table will appear monthly. Corrections and suggestions are invited.

AIRPLANES AND SEAPLANES AS COMPILED BY AVIATION

DOES NOT ASSUME RESPONSIBILITY FOR THE FIGURES GIVEN

Normal gross weight loaded	Performance with full load at sea level as supplied by manufacturers. High speed in m. p. h.	Cruising speed in m. p. h.	Landing speed in m. p. h.	Climb at sea level in f. p. m.	Climb to 10,000 in minutes	Service ceiling in feet	Fuel capacity in gallons	Normal range in miles	Normal fuel consumption at cruising speed Gal per hr.	Fuselage construction	Wing construction	Are wings wired for lighting?	Type of control	Brakes	Type of shock absorber	Type of pontoons provided for	Additional cost with pontoons	Dept. of Commerce type certificate number	Performance figures guaranteed?
1800	160.6	95	30-40	750	29	12000	37-60	550	7.5	Wl-ST	Wd-F	No	SPD	Extra	Hy	EFHm	$1,100	13	No
2230	100.6	87	34	514		10200	46	435	10.3	Wl-ST	Wd-F		SCD		RC	E		7	
2230	97	85	30	600		11000	46	425	10.2		Wd-F	$20 ex.	SCD		RC	E		8	
2057	101	85	30	575	45	12000	42	425	7.5	Wl-ST	Wd-F	No	SPD	Extra	R	E	$990	17	Yes
9060	122	100	55	720	24	12500	185	580	32	Wl-ST	Wd-P	Yes	CDeD	Yes	RC			Apl	5% N
4000	118	98	48	500	40	11500	78	600	12	Wl-ST	Wd-P	Yes	SCD	Stand	RC			9	5% N
4000	115	93	48	500	40	11000	78	550	13	Wl-ST	Wd-P	Yes	SCD	Extra		Hm		9	
4200	140	120	50	1250	13	21000	117	700	20	Wl-ST	Wd-P	Yes	SCD	Extra	RC	Yes			
4750	135	116	42	1300	11	19600	120	700	20	Wl-ST	Wd-P	Yes	SCD	S-B	RC	Yes		Apl	5%
5050	130	113	46	1200	13	18500	120	675	20	Wl-ST	Wd-P	Yes	SCD					Apl	5%
5500		100	45				150								O				
	107	90	35	500						Wd, P	Wd-F								
3700	128	110	46	850		13000	85	800		Wl-ST	Wd-F		SCD		RC				
2550	130		40	900		15500	80			Wl-ST	Wd-F				RC				
2295	90	80	30	450	85	10000	35	325	9	Wl-ST	Wd-F	Yes	DSC&P	Extra	RC	E	$900	Apl	Yes
5500	130		54	770	19.5	15000	100			Wl-ST	Wd-F	Yes	S	Yes	O			2	
	120	100	40				78	650		Wl-ST	Wd-F		SC		RC				
3700	120	95	50	700	45	13500	70		15	Wl-ST	Wd-F	Yes	SC	Yes	RD	Metal	$2,500	12	
	102	87	35	700	35		25	400	4	Wl-ST	Wd-F	Yes	SP		RC				Yes
1400	95	64	47			18000	40	500	6	ST or Wd	Wd-F	No	D		RC			No	
	130	110	40	1350	10		80	600		DT, S	Wd-F		SPA						
	95	83	40	600		16000	60	600		DT, S	Wd-F		SPA						
	120	100	47	1000		18000	75	600		DT, S	Wd-F		SPA						
4867	126	105	45	1250	19	15000	100	525	20	Wl-ST & D	Wd-F	Yes	SC	No	TR			No	
4049	146	125	45	1050	10	16000	100	625	20	Wl-ST	Wd-F	Yes	SC	No	RC				
4600	140	120	55	580	12	18000	160	1050	18	Wl-ST	Wd-F	Yes	CP-S	Yes	Hy	F		20	
5150	130	110	58	420	21	12000	160	950	18	Wl-ST	Wd-F	Yes	CP-S			F		20	
3650	122	103	53	580	27	13100	110	710	15.5	Wl-ST	Wd-F	Yes	CP-S	Yes	Hy	F		10	
3900	112		53	1250	36	12700	110	650	15.5	Wl-ST	Wd-F	Yes	CP-S			F		10	
780	85	75	35	1660	10	15000	10	225		Wl-ST	Wd-D-F	No	SC	No	RC	None		15	
3850	120	125	50							D-corrug.	D-corrug.								Yes
3750	110		50							D-corrug.	D-corrug.								Yes
815	70	65	32	200			3.3	120		R-ST	Wd-F	No	SC	No	RC				
2121	100	87	35	600		10500	40	450		Wd			S	Extra	O				5%
2589	120	105	37	800		12000	66	550		Wd	Wd-F		S	Extra	O			Apl	5%
2589	140	120	35	1000		16000	66	700		Wd	Wd-F		S	Extra	O			Apl	5%
3393	130	110	40	800		15000	106	1000		Wd	Wd-F		S	Extra	O			Apl	5%
3358	95	85	46	650	35	11000	71	500	12	Wd, D	Wd-F	Yes	DeD	No	O			Apl	5%
525	90	75	28	400	65	12000	8	300	1.7	Wd	Wd-F	Yes	SC		RC	Wood		Apl	6%
975	90	75	30	600	60	12000	20	500	3.4	Wd	Wd	Yes	SC	No	RC	Wood	$175	Apl	6%
550	85	75	26	400	75	12000	10	400	1.7	Wd	Wd	Yes	SC	No	RC	Wood	$225	Apl	6%
3285	112			800		14000	60			Wl-ST	Wd-F						$175	Apl	
10841	112		57	570				500		Wl-ST	Wd-F							Apl	
1500	110	90	35	750	45	14000	27	400	6	Wd	Wd-F	No	SD	No	RC			19	Yes
2000	102		40	540		12000		400		Wl-ST	Wd-F	Extra	SD	No	RC	EHm	$1,000		5% N
2200	100		35	600			42	500		WlST	Wd-F								
3200	135	110	50	1000	16	15900	100	700	10	monocoque	Wd-P	Yes	SC	Hy	RHy	E		Apl	5%
3645	167	135	55	1460	10	17250	100	1000	18	monocoque	Wd-P	Yes	SC	Hy	RHy			Apl	5%
3750	160	135	55	1250	13	16000	100	700	18	monocoque	Wd-P	Yes	SC					Apl	5%
3300	126	108	49	1000		16000	83	700	10-11	Wl-ST	Wd-F		SC	Extra	RCT	E		Apl	Yes
1200	110	90	35	800				360		Wl-ST	Wd-F	Yes	S		O			Apl	
2090	93	85	35	600		15000	35	396	8	Wl-ST	Wd-F	No	S	No	RC				
2083	100	85	35	500	25	12500	38	400	9	Wl-ST	Wd-F	Extra	SPD	Extra	RC	EHm	$1,000	Apl	
2513	136	90	45	1600		11000	60	600		Wl-ST	Wd-F	Yes	S	Yes	Aerol		$900		5%
1950	1015	105	45				35	400		Wl-ST	Wd-F		S					18	Yes
3350	115	82	52	500		10000		400	21	D-corrug.	D-corrug.				Gruss				
2700	95	100	45				42			WD	Wd-F		DeCP						
7600	115	100	51	400		11000	326	1000	25	Wd-D	DOR&B		DDe		RDO				5%
15000	122	112	58	650		16000	370	790	50	DOR&B	DOR&B		DDe	Hyd	RDO			Apl	5%
2140	94	78	38	400		8000	37	400	7	Wl-ST	Wd-F	Yes	PC	Stand	RHy	D		Apl	5%
2400	130	110	41	1000		18000	65	620	11.5	Wl-ST	Wd-F	Yes	PC	Stand	RHy	D	$1,200	Apl	5%
3280	118	100	46	600		13500	70	600	11.5	Wl-ST	Wd-F	Yes	DDe	Stand		M		Apl	5%
3485	128	105	55	750		14000	90	700	11.5	Wl-ST	Wd-F	Yes	DDe	Stand	RC	M	$2,500		5%
10000	114	100	59			14000	235	540		D corrug.	D corrug.	Yes	DDe	Stand	O		$2,500	16	
2250	95		35				36		9	Wl-ST	Wd-F				RC				
	114	95	32			15000	43			Wl-ST	Wd-F		S					21	
2100	100		40				42		8	Wl-ST	Wd-F	Yes	SP	No	RC				
2400	130		45				60		12	Wl-ST	Wd-F	Yes	SP	No	RC				
3600	128		55	750		13600	75		12	Wl-ST	Wd-F	Yes	SC	Yes	RC				
1900	97	90	35	600		14000	40	350	8	Wd&WlS	Wd-F	No	S		C	E			5%
2000	95	85	30	600	20	12000		500	8	Wl-ST	Wd-F	No	DSC	No	RC	Own	$1,000		
	100	85	35	600		20000				Wl-ST	Wd-F		C		Aerol				

FUSELAGE AND WING CONSTRUCTION:
Wl—welded
R—Riveted
S—Steel
Wd—Wood
D—Duralumin
T—Tubing
O—Open section
B—Bolted
P—Plywood cover
F—Fabric cover

BRAKES:
S—Sauzedde
B—Bendix
L—Lockheed

LIGHTS:
N—Navigation lights

CONTROL:
C—Cables
P—Push rods
De—Deperdussin
S—Stick
D—Dual.
A—Arens

SHOCK ABSORBER:
Hy—Hydraulic
R—Rubber
C—Chord
D—Compression
T—Trombone
O—Oleo

GUARANTEE:
N—New

PONTOONS:
E—Edo
Hm—Hamilton
F—Fairchild
M—All metal.
D—Duralumin

TYPE CERTIFICATE:
Apl—Applied for and is pending.

The "Command-Aire"

(*Continued from page* 325)

chrome molybdenum frame. The wing structure is of wood with solid spars and ribs built up of plywood web with spruce cap strips. The nose ribs are of similar construction while the compression ribs, like the fittings, are of chrome molybdenum steel. To brace the wing tip wide pieces of solid spruce are used from the last rib to the end of the wing. Fittings on the wing spars, both where the lower wings are attached to the fuselage and where the top wings are joined to each other, are of the box type and each individual spar is com-

Rear three quarter view of the Command-Aire. Note how the ailerons are set in from the wing tip. There are no struts or wires to obstruct the pilot's vision forward.

pletely encased by a fitting extending eight inches from the end of the spar, making for unusual strength. All wing panels are sprayed for waterproofing, and Lionol is used to render all metal parts impervious to weather conditions.

The tail surfaces are constructed entirely of chrome molybdenum steel and covered with fabric. The surfaces have an individual shape giving the plane a distinctive appearance in flight. Both rudder and elevators are somewhat smaller than usual, but as was mentioned above, the designer claims that the shape of the fuselage makes the slipstream very effective. All elevator controls are completely enclosed, but inspection plates are provided so that the moving parts can be easily inspected and lubricated. Both stabilizer and vertical fin are adjustable.

The Command-Aire is one of the few OX-5 open cockpit biplanes produced during the past year that has a distinctive and original appearance. Its performance in service and its adaptability to large scale production remain to be seen. However, its general appearance is promising and according to reports its performance is very good being very sensitive to the controls. As the plane was designed for a modern power plant its performance should be considerably increased with a higher powered engine.

Powered with an OX-5 the manufacturers specifications are as follows:

Span (both wings)	31 ft. 6 in.
Overall length	24 ft. 6 in.
Height	8 ft.
Chord	5 ft.
Gap	5 ft.
Stagger	17 in.
Wing area	300 sq. ft.
Useful load	800 lb.
Full load	2075 lb.
High speed	104 m.p.h.
Landing speed	36 m.p.h.
Cruising radius	400 mi.

Chamberlin Begins Tour of Nation Flying a Sperry Messenger Plane

CLARENCE D. CHAMBERLIN has begun his 30,000 mi. tour which is to take him to every state in the union as well as to Cuba in an itinerary which includes more than 100 cities. The tour officially began from Curtiss Field, L. I., at 2:50 P.M. Jan. 23, but the start which will be remembered occurred shortly before that time when Chamberlin took off from between a row of trees on a Garden City street a short distance from the field to prove that the coming owner of the "flivver" plane will not always need an airport.

Lacking one of the Chamberlin two place sport planes on which construction has been started, the New York to Germany flier began the trip in a small Lawrence B. Sperry Messenger biplane which is less than 30 ft. in wing spread and weighs, with its Lawrance 60 hp. three cylinder air-cooled engine, less than 850 lb. Chamberlin discovered this plane in a Farmingdale factory, where it is said to have lain packed away for the last eight years. He had it rebuilt to be used during the first part of his tour. In April he expects to receive one of his own small planes when he will fly west from the Southern Atlantic States.

The beginning of the trip in which Chamberlin is to make hundreds of addresses in the interests of American aviation has, as we go to press, already taken the flier to Allentown, Harrisburg and Altoona, Pa. Enthusiastic receptions have met him in each city; and the schedule has been marred but once, this instance being when a landing was necessitated at Mifflin, Pa., when bad weather forced him down on the flight from Harrisburg to Altoona.

Chamberlin had planned to return from Pennsylvania to Curtiss Field during the last week in January to make another attempt to break the world's endurance record with Roger Q. Williams, his co-pilot, in A. R. Martine's Bellanca monoplane. Heavy weather prevailing in the section, however, brought Chamberlin to change his plans, and the attempt

Clarence Chamberlin taking off from the roadway near Curtiss Field, L. I., N. Y.

was later scheduled to take place from Richard E. Byrd Field at Richmond, Va., when the flier arrived at the more southerly city the following week. The Bellanca plane, according to arrangements, would be taken south for this flight.

From Richmond, Chamberlin will fly south to Pinehurst, N. C., Columbia, S. C., Jacksonville, Fla., and Ft. Myer, Fla. From the latter city he will fly to Cuba at the invitation of President Machado, later to return to Coral Gables and resume his tour westward through the Southern states.

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The Richmond "Sea-Hawk"

A Five Place Monoplane Flying Boat Powered With Curtiss K-6 Engine And Built by the Richmond Airways, Inc.

RICHMOND AIRWAYS, Inc., of Greenridge, Staten Island, N. Y., recently completed their latest product, a pusher flying boat powered with a Curtiss K-6 engine. Richmond Airways "Sea-Hawk" is a five passenger open cockpit monoplane with the engine mounted above the wing. The pilot and passengers sit in the hull. The plane is of quite conventional design with the combination wood and duralumin hull and fabric covered wood wings externally braced. The most radical features of the plane are the dual rudders and vertical fins, mounted below the stabilizer in the slipstream.

The "Sea-Hawk" afloat during the trial flights at Fresh Kill Creek, Staten Island, N. Y.

The Richmond Airways "Sea-Hawk" is a five place open cockpit monoplane with pilot and passengers sitting in the hull. There are two cockpits, the forward one being fitted with dual, side by side control and the rear one with a seat wide enough for three passengers. The hull has a V bottom with two steps, wooden frame with Haskelite sides and deck. The bottom is of duralumin, fastened to the frame with wood screws. The general outline of the hull shows good streamline form making it seaworthy and navigable on the surface.

In the front of the forward cockpit at the very nose of the hull is space for an anchor or any other equipment. The forward cockpit is provided with conveniently Deperdussin control with the entire mechanism behind the instrument board. The rudder pedals are of a stirrup type with cables attached and passing over micarta pulleys to the push and pull rod of the rudders. The horizontal stabilizer is adjustable in flight by a sprocket and chain in the cockpit and another in the empennage. The engine controls are operated by cables. The rear cockpit is quite large with ample room below the passenger seats for baggage. In back of the rear cockpit in the hull, just below the engine there is located a main fuel tank of 42 gal. on the center of gravity. The tank has a pressure feed to the engine above it.

The wings are of wood, covered with fabric in the usual manner. It is of the semi-cantilever type with box spars having two ply mahogany veneer flanges screwed and glued to the webs. The box spars are filled with blocks in a conventional manner at the fittings. The ribs are of Warren tube construction with tubular rivet fastenings to the web. The ribs are spaced 14 in. apart. The ribs are built up with three ply spruce cap strips. The entering edge is covered with three ply mahogany veneer, while the trailing edge is of wire. Conventional heavy wire is used for the diagonal bracing to take the drag loads. All of the fittings are built up of welded flat sheet steel having high strength factors. The covering is Flightex, finished with six coats of Ti-Two dope. The trailing edge of the wing is perforated at intervals to

The "Sea-Hawk" on the runway of the Richmond Airways, Greenridge, Staten Island, N. Y. Note the dual rudders.

Fokker adopts AIRCRAFT BERRYLOID

FINDING that no other material could protect and beautify Fokker Aircraft as well as Aircraft Berryloid, the officials of the Atlantic Aircraft Corporation have adopted this high luster lacquer as their standard finish. Roma Brown and Black Aircraft Berryloid feature the new "Super" Universal recently announced by this concern.

This selection of Berryloid as standard is distinctly in line with the insistence of purchasers of high grade airplanes that the finish must possess beauty and durability. For this reason leading builders of commercial aircraft have unanimously adopted Aircraft Berryloid as the one finish that perfectly fulfills these requirements.

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drain any water that may be absorbed. The external bracing is of streamlined, laminated spruce members, 5½ in. wide by 1⅞ in. thick. They are 11 ft. long and supported in the hull by quarter inch rods running athwartship.

The engine bearers and supports are of streamlined, laminated spruce and are trussed in the form of an N, and wire braced, eliminating the customary Sampson strut. The engine is mounted above the wing with the propeller at the rear acting as a pusher. The wing tip floats are of the V type. They are of duralumin, manufactured by Edo Aircraft Corp.

George Schaaf, president of Richmond Airways, Inc., in the cockpit of the Sea-Hawk.

The empennage has two vertical stabilizers and two vertical rudders. The two rudders are interconnected with a push and pull tube. The rudders and vertical stabilizers are beneath the horizontal stabilizers. Vertical stabilizers are somewhat radical as they are raked aft at an angle of 15 deg. and are 42 in. apart. The elevator is operated by push and pull tube. The entire empennage is well above the deck away from the water and in the full slipstream.

One model of this type, the Sea-Hawk, is now complete and it was recently tested by George H. Schaaf, president of the Richmond Airways, Inc., in Fresh Kill Creek, Staten Island, N. Y. The plane showed remarkable maneuverability on the water and by gunning the engine hard over rudder, the Sea-Hawk practically turned in its own length. In the air the plane performs very well being exceptionally stable.

The characteristics of the Richmond Airways' Sea-Hawk as supplied by the manufacturer are as follows:

Length overall	28 ft. 4 in.
Wing span	46 ft.
Chord	7 ft. 4 in.
Wing area	317 sq. ft.
Wing section	U.S.A. 35
Dihedral	1½ deg.
Incidence	3 deg.
Power	C-6 160 hp.
Weight empty	1700 lb.
Useful load	1000 lb.
Weight per sq. ft.	8.51 lb.
Pounds per hp.	17 lb.
High speed	95 m.p.h.
Low speed	45 m.p.h.
Cruising range	4 hr.

The first one of these flying boats will be retained for demonstration and passenger flights. The boat was designed by George H. Schaaf working in conjunction with the Richmond Airways, Inc., of which he is president, and the following staff: L. S. Van de Nyden, vice-president and treasurer; A. B. Eriksen, secretary and manager.

Odenbreit Engine Shows Smooth Operation in Preliminary Tests

PRELIMINARY TESTS of the new Odenbreit engine, mounted in a Thunderbird biplane and flown from the American Airways Field, Los Angeles, Calif., have shown a smoothness of operation at all speeds and under all conditions that is claimed to be unequalled by any commercial engine now on the market. This engine will soon be in quantity production and will sell in the comparatively low priced class.

Although final tests have not as yet been made on the maximum power, fuel consumption, and r.p.m. that this engine may be expected to deliver when mounted in the standard three place commercial plane, the tests thus far have shown that it will turn up 1850 r.p.m. in the air, has a maximum horsepower of around 160, will turn better than 120 m.p.h. with the Thunderbird, and with it all has an utter lack of vibration.

This engine is a seven cylinder radial of more or less conventional design. It has a divided crankcase, master rod, two piece crankshaft, all accessories, tappet rods and flow pipes located behind the engine, and steel cylinders with aluminum fins.

New Western Coast Corporation Produces Seven Place Biplane

ORIGINAL IN design, the Semi-Coach is the first plane to be produced by the O. W. Timm Airplane Corp. of Glendale, Calif. This plane is a seven place, dual control, cabin biplane with welded steel tube fuselage and conventional wood wings. Five passengers are comfortably seated in the cabin which is so constructed that the rear half of the cabin roof may be removed at will, giving either a semi-open plane or a completely enclosed cabin. The two pilots are seated side by side, forward and considerably higher than the cabin, separate controls being provided for each pilot.

This plane is being built to order for a local gun club and has been designed especially for high altitude work, landing and taking off from small fields among the mountains of the coast range, taking the club members to out of the way hunting grounds, and providing a large overload capacity for normal work.

The spread of both wings is 45 ft., wing area is 500 sq. ft., plane is equipped with a Menasco converted, Superposed-Salmson radial engine and will have, fully loaded, a cruising radius of about 4½ hr.

Mr. Timm has designed an experimental twin engined monoplane that shows great promise. It has been wind tunnel tested by Prof. A. A. Merril, at the University of California, and according to the figures it will show good performance on but one engine with full load. Mr. Timm is not ready to give out details of this plane as yet but will have it under construction within thirty days.

The O. W. Timm Airplane Corp., Glendale, Calif., is now engaged in building custom built airplanes for private individuals. This company was formed by Otto Timm, and has been financed by him so far. The officers are G. A. Duncan, former mining engineer, Pres., and O. W. Timm, Vice Pres.

Trial Flights Made in Fairchild Plane Built for Duration Attempt

SUCCESSFUL TRIAL flights were made late in January in the new Fairchild-Caminez cabin monoplane which is to be used in an attempt to better the world's flight duration record which went to Germany when Cornelius Edzard and Johann Ristiez remained in the air for 52 hr. 23 min. last August. The new attempt will be one of many being made in this country to bring the record back to the United States.

Called the "mystery plane" because the officials of the Fairchild Aviation Corp. have veiled its building and flights in secrecy, the semi-cantilever monoplane will stay aloft for 65 hr., if the hopes of its makers achieve actuality. The plane is equipped with the new Caminez four cylinder 135 hp. engine which is claimed to have a low fuel consumption which makes possible a flight of greater duration.

According to reports the plane when loaded will weigh 4,800 lb., weighing 2,090 lb. empty. The gasoline, of which 350 gal. will be carried, will be mainly stored in special wing

The Fairchild monoplane with Caminez engine on its trial flight at Curtiss Field, L. I., N. Y.

tanks each of 150 gal. capacity, while the remaining 50 gal. will be kept in a cabin tank. Twenty gal. of oil will care for the lubrication.

Lengthened for the endurance flight, the wing spread is 50 ft. with an area of 350 sq. ft. in lifting surface. The wings of the plane are of the folding type.

Appoint Wilkes Aero & Transfer Co. American Eagle Distributor

WILKES AERO and Transfer Co., Inc., of North Wilkesboro, N. C., has been appointed distributor for the American Eagle Airplane Co. in North and South Carolina. The president of the company is A. B. Somers.

The AIRSEDAN

Safety

Built under Department of Commerce Certificate of Airworthiness **No. 12.** *Approved for* **1000 lbs.** *pay load.*

INSURANCE

Full coverage will be granted for all passengers, because they cannot interfere with the controls.

SPECIFICATIONS

Seating Capacity	pilot and 4 pass.
Weight Empty	2100 lbs.
Wing Area	320 sq. ft.
" Span	42 ft.
High Speed (sea level)	120 M.P.H.
Engine,	Wright Whirlwind

EQUIPMENT

Self Starter, Metal Propeller, Compass, Air Speed Indicator, Navigation Lights, Tachometer, Altimeter, Clock, Fire Extinguisher; Fuel, Oil Pressure and Oil Temperature Gages; Air Corps Throttles, Strainer, and Fuel Valve, Exhaust Manifold with Muffler and Cabin Heater, Metal Mail or Baggage Compartment.

The Ideal Commercial Plane

Price $12,500 Flyaway
Completely equipped

BUHL AIRCRAFT CO.

Marysville, Michigan

To Hold All-American Aircraft Show in Detroit April 14 to 21

DETROIT, MICH., has been selected for the national aeronautical exhibition this season to be held April 14 to 21, inclusive, and to be known as the All-American Aircraft Show. It will be conducted by the Detroit Board of Commerce in cooperation with the Aeronautical Chamber of Commerce and that the show will be one of the finest has already been indicated, according to Manager Ray Cooper, since dozens of letters have been received with inquiries concerning exhibition space reservations. Frank W. Blair is chairman of the Aircraft Events Committee and William B. Mayo of the Ford Motor Co. is chairman of the Show Committee.

No charge shall be made for floor space to exhibitors of aircraft, it is stated in a recent bulletin of the Aeronautical Chamber, and only a nominal charge of $.50 per foot shall be made for the exhibition of engines, accessories, parts, supplies, etc. There will be 166,000 sq. ft. of floor space.

Lieut. "Smiling Jack" Harding, U. S. Army round-the-world flier of 1924 now connected with the chamber, has been appointed to represent the industry. He will actively participate as a member of the important show committees, and he has announced that he will assist Mr. Cooper in Detroit.

All manufacturers of airplanes and airplane appurtenances are eligible to exhibit their products whether they are members of the Aeronautical Chamber of Commerce or not, it has also been announced. The Ford Motor Co. recently stated that the Dearborn Airport will be available to exhibitors and visiting airmen at all times and that utilization of the field for demonstrating purposes will be welcomed.

Rules and exhibition application blanks have been mailed, and Mr. Cooper expects all of the floor space to be quickly reserved. Allotments are to be made about March 1.

In preparation for the show, Chairman Frank W. Blair of the Aircraft Events Committee has appointed a show committee consisting of William B. Mayo, chairman, William E. Metzger, vice chairman, Harry G. Graham, Thomas S. Merrill, Carl H. Keller and Capt. L. R. Woolson. William B. Stout has been named chairman of a committee on program and entertainment.

Manufacture of Air-Cat Engine is Planned by Cincinnati Interests

ANOTHER LEASE on life has been promised the Detroit Air-Cat engine. This comes with an announcement that the R. K. LeBlond interests, connected with the machine and tool company of that name in Cincinnati, are preparing to manufacture the engines in two series of three sizes each, according to reports from Cincinnati, O.

Glenn D. Angle and Robert Williams, formerly of the Detroit Aircraft Engine Corp. which introduced the Air-Cat, are in Cincinnati; and it is said that the LeBlond interests are planning to purchase the assets of the Detroit firm.

The plans call for six engines. In the first series there will be a three-cylinder engine developing 50 hp., a five-cylinder developing 70 hp., and a seven-cylinder developing 90 hp. In the second series, the five-cylinder engine will develop 110 hp., the seven-cylinder, 135 hp., and the nine-cylinder 165 hp. Such a range of power in six engines is calculated to cover a wide field of aircraft needs.

Production of the Air-Cat, it is said, will begin in about three months with a working force of between 100 and 150 men employed. Whether manufacture will be a division of the LeBlond company or by a separate corporation has not yet been announced.

New Winter Flying Suits

U. S. Navy Surplus, Lined with Persian Angora

We have just purchased a small lot of these suits and offer them to you at a very low price.

Don't miss this opportunity to get the best bargain yet offered in high grade winter flying clothing.

These suits are made of water-proof cloth and lined with Persian Angora Mohair, which makes them comfortable, warm and durable.

Patent quick fastener, high collar and comes to you complete with woolen moccasins and helmet.

Don't delay — fill out order blank, now.

Price $30 complete

JOHNSON AIRPLANE & SUPPLY CO.

DAYTON, OHIO

JOHNSON AIRPLANE AND SUPPLY CO., DAYTON, OHIO

Enclosed find $———— for which send flying suit to

Name ————————————

Address ————————————

Heath Airplane Co. to Distribute Lincoln-Page Planes in Illinois

DISTRIBUTORSHIP OF the Lincoln-Page airplane in Illinois and also portions of Indiana and Wisconsin has been granted to the Heath Airplane Co. of Chicago, according to a recent report from the Lincoln Aircraft Co., Lincoln, Neb. A description of the Lincoln-Page, which is a three place open cockpit biplane, was published in AVIATION, Oct. 31, 1927.

It is understood that the Heath Airplane Co. will continue to produce its Heath Parasol monoplane besides carrying on the distribution of the Lincoln-Page.

Cameron Seven Cylinder Engine is Now on Display in New York City

THE NEW Cameron aviation engine, a product of the National Aero Corp., designed by Everett S. Cameron, is now on display at the company's showroom, 100 E. 42 st., New York City. This is the first of three engines which the company plans to put in production.

Several features are incorporated in this new engine. It is a seven cylinder, radial air cooled of conventional type designed to develop 100 hp. at 1800 r.p.m. However power curves are not available at this time. Dual valves are used operating in a chamber directly above the cylinder head exactly opposite each other. In this construction the incoming gases are heated by coming in direct contact with the exhaust valves and in a reverse manner the exhaust valves are cooled by the incoming mixture. In addition to this there are a number of cooling fins directly on top of the cylinder head. A new type of valve operating mechanism is used; it is by means of oscillating valve stems, which are designed to give the valves a more direct push.

The ignition cables run through metal guides protecting them from wear and giving the engine a very clean-cut appearance.

The Cameron engine is of a high compression type with a ratio of about 6 to 1. The weight of the engine is about 280 lb. It is claimed that this engine has high thermal efficiency and is very adaptable to production on a large scale. The price is quoted at $1,500.00 f.o.b., factory, and will be ready for the market in the near future.

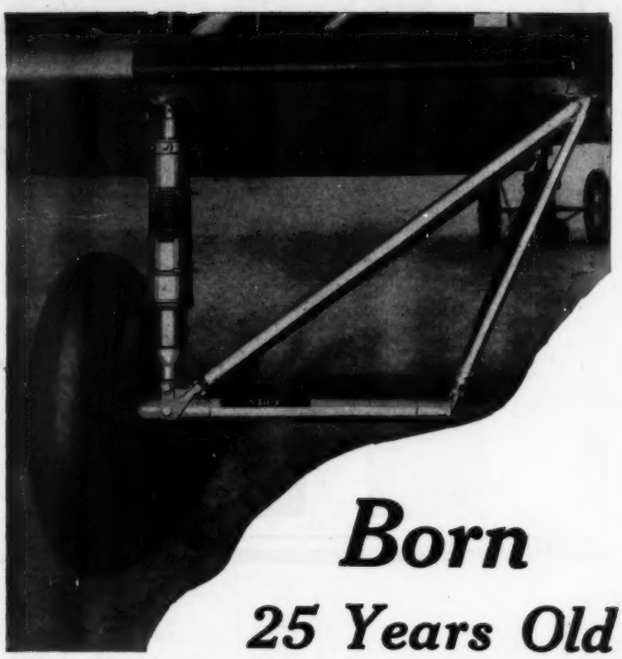
Corporation is Formed in Oregon To Produce the Davis Cabin Plane

SIX AND eight place cabin type monoplanes are soon to be manufactured in Portland, Ore., by the Davis-Langman Aircraft Corp., it is reported. Incorporation articles of the company calling for a capital stock of $250,000 were recently filed at Salem, Ore., by Roy J. Davis, James D. Langman, and J. D. Clemence.

The Davis monoplanes, it is understood, are to be used for heavy commercial work. Alloy steel tubing is used throughout the entire fuselage, with spruce and Douglas fir employed in the wing construction alone. One of the planes is now used by the Langman Electric Corp., while another has been in the Brubaker Aerial Survey service for some time.

The present assembling plant is small, but with five orders for planes a greater output speed is contemplated. By March the company plans to employ a force of 30 or 40 men and manufacture two monoplanes a week.

Roy J. Davis, president of the Davis-Langman Aircraft Corp., has been in the aeronautical field since 1909 at which time he was a student at Curtiss Field, San Diego, Calif. He was also with Lincoln Beachy at one time in the capacity of mechanic.



Born
25 Years Old

EVER SINCE 1900, The Cleveland Pneumatic Tool Company, manufacturers of Aerol Shock Absorbing Struts, has been testing and applying compressed-air-controlled devices. The success of the Gruss Air Spring, and our recent acquisition and improvement of the Westinghouse Air Spring, has made us the foremost manufacturer of pneumatic shock absorbers.

When aviation demanded a shock-absorbing landing gear, it was not necessary for us to experiment, but merely develop and apply the principles we had been successfully applying for 25 years.

But even then Aerol Shock Absorbing Struts were not placed upon the market until they had been exhaustively tested and proven on our own plane.

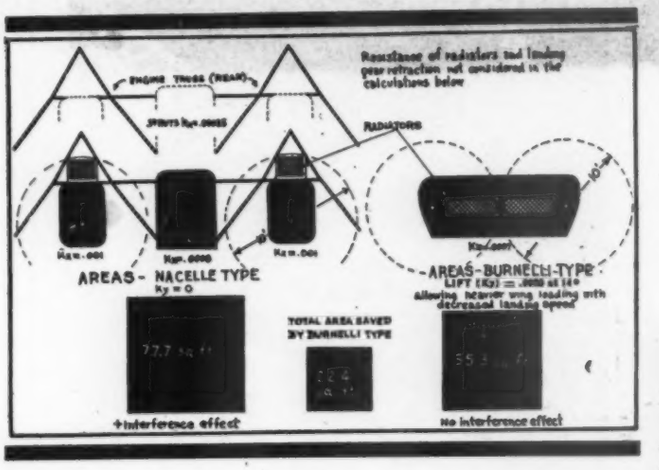
Today there is a set of proven facts on these struts. (1) They absorb, without rebound, shock loads equal to more than twice the weight of the plane. (2) They enable you to taxi smoothly regardless of the condition of the ground. (3) They make forced landings less hazardous. (4) They protect and prolong the life of the plane.

We will gladly send descriptive literature to any interested party.

CLEVELAND PNEUMATIC TOOL CO.
3737 E. 78th St., Cleveland, Ohio

AEROL shock absorbing STRUT

ABOUT LIFT


Resistance of radiators and landing gear retraction not considered in the calculations below
RADIATORS
AREAS - NACELLE TYPE
Ky = 0
AREAS - BURNELLI TYPE
TOTAL AREA SAVED BY BURNELLI TYPE
+interference effect
no interference effect

THE airfoil fuselage of the Burnelli type lifts in excess of the equivalent wing area of the fuselage width. This utility of fuselage area allows heavier wing loading with increased speed range and also an extensive increase of L/D.

Some Advantages of the

BURNELLI TYPE

Accessible multiple engine compartment
Extensive reduction of head resistance
Reduced turning moment on one engine
Fuselage lift reduces landing speed
Increased capacity of the fuselage
Structural efficiency and simplicity

REMINGTON AIRCRAFT CORP. BURNELLI

247 PARK AVENUE, NEW YORK CITY

The Martin "Eureka" Section

(*Continued from Page* 322)

to accurate reproduction in great quantities by ordinary labor, and all details must flow in a smooth, steady stream to a rapid and accurate final assembly. There must, above all, be no interruption in the rapidly moving final assembly process.

It may be readily seen that individual structural shapes which are adapted to simple attachment and connections fulfill another important requirement for successful quantity production. The details can be made in huge quantities in small floor space, with great accuracy and completely prepared for rapid assembly. Surplus quantities can be efficiently stored

Bulb section and other shapes formed in the 14 ft. bending brake after heat treatment at the Glenn L. Martin factory.

to insure uninterrupted final assembly; or to fill indefinite spare parts requirements, without involving time, labor and floor-space required to make and store major units.

Although this re-scrutinizing of aircraft construction was undertaken four years ago primarily as an engineering problem, it has had a profound effect not only upon production tools and methods, but, far more important, upon the whole production policy.

Heretofore the constant shifting of construction types has restricted development of production capacity, and caused a constant rearrangement of tools and labor, and floor space.

The universal application of structural members designed from fundamentals and made from basically correct material places production plans at last upon a firm foundation. For the first time in the history of aircraft it is possible to adopt permanent machinery for large scale manufacture—machinery whose universal capabilities match the wide-spread application of the forms it produces.

Beginning from this firm foundation a permanent plan of mass production is being built up, based on the correct principles of manufacture, incorporating everything necessary to preserve universal application and great capacity per unit floor space for producing detail parts, and leading finally to the life stream of the plant—the final assembly.

The Martin producing organization is not satisfied, however, to stop with the "first line" machinery and tools which are directly connected with fabrication of parts. There is already in operation a "second line" of machines which do not make airplane parts. These machines have precision far beyond ordinary tool room machinery, and they are used only to make jigs and fixtures for production use, and stand as a symbol of the future when tool-making by hand will be inadequate.

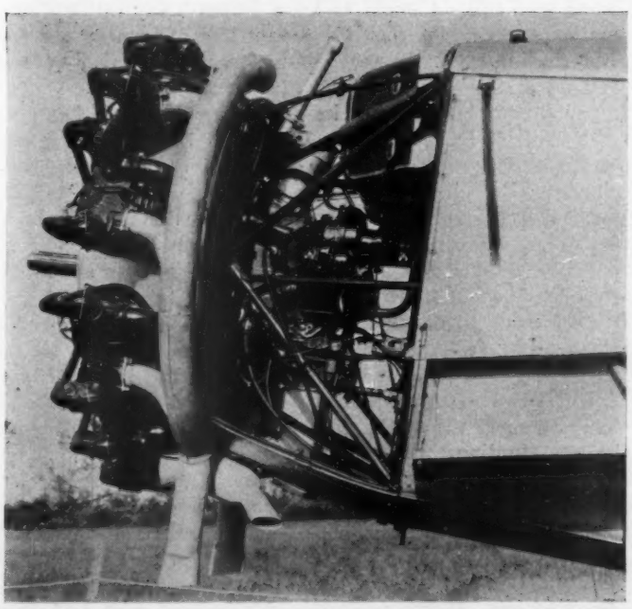
Pratt and Whitney Engines In Boeing Mail Planes

(*Continued from page* 324)

Of particular interest from the engine standpoint is the following table representing engine performanc through this period:

	Engine Time			
Engine No.:	*Since Overhaul:*	*Total:*	*Plane No.:*	*Station:*
250	62:57	324:26	C-289	Oakland
238	128:30	374:17	C-277	"
217	None	186:55	C-276	"
230	27:56	382:08	C-290	Reno
236	32:35	400:39	C-292	"
239	41:15	330:46	C-275	Salt Lake
232	126:19	378:43	C-269	" "
234	1:20	375:21	C-286	" "
275	None	235:01	C-288	" "
216	111:14	385:31	Shop	" "
240	204:33	397:51	"	" "
227	None	148:33	C-272	Rock Spgs.
235	63:02	282:44	C-280	Cheyenne
222	149:08	404:59	C-270	"
233	110:32	401:32	C-273	"
224	103:37	277:37	C-274	"
231	85:49	331:13	C-282	"
237	62:15	314:52	C-291	"
229	155:39	212:46	C-285	Omaha
225	12:11	300:23	C-278	"
221	79:49	342:14	C-279	"
219	16:05	235:10	C-287	"
274	103:42	263:26	C-268	"
228	None	298:32	Shop	"
226	None	292:07	Stored	"
223	None	280:36	C-283	"
251	97:37	375:41	C-284	Chicago
218	229:58	275:59	C-281	"

The loads on the western division of the transcontinental route particularly have now reached a point where the Wasp



Installation of Wasp engine in Boeing mail plane showing the exhaust collector ring and carburetor heater. No. 6 cylinder has its exhaust pipe jacketed with a stove and the hot air is led to the carburetor-intake scoop.

will be gradually replaced by the larger Pratt & Whitney "Hornet". A number of Hornet engines are now on order by the Boeing Air Transport for this and other purposes. Boeing Air Transport propose to use the withdrawn Wasp engines for installation in their new Boeing tri-engine passenger planes. These planes are to be put into service next spring between Chicago and San Francisco.

Performance the Only Test

AN OWNER of six Travel Air Biplanes says:

"They are all right and if they weren't we wouldn't be buying them. Our run undoubtedly taxes a machine to the limit, and when I say it is good, you can depend upon it that it is. Possibly no other company in the United States has the opportunity to test a machine under such severe conditions.

"One of these machines has had over 1500 hours flying time with no replacements or covering. Another of them is used by the flying schools. It has had over 3000 flying hours and is still in good condition."

Practical experience; steady development; nothing but the best in materials and construction—these are the foundation stones upon which the success of Travel Air has been built—the reasons why it is steadily receiving the unqualified endorsement of the air-minded everywhere.

Descriptive Catalog on request

Travel Air Mfg. Co., Inc.

General Offices:
WICHITA
Kansas

Truscon Hangar for the Fairchild Airplane Manufacturing Corp., Farmingdale, L. I.

AIRPLANE HANGARS

Truscon Airplane Hangars are permanent and fireproof. They are assembled from standardized units which can be combined into buildings of any desired length and width. Being laid out in clear spans, their unobstructed floor space assures utmost freedom in handling ships.

Large Sliding Doors

opening the full width of the building, simplify the storing of planes. We furnish Steel Doors for any requirements.

TRUSCON STEEL COMPANY
YOUNGSTOWN, OHIO
ESTABLISHED 1903
Manufacturers and Engineers
WAREHOUSES AND OFFICES IN PRINCIPAL CITIES

TRUSCON BUILDINGS

for all airport requirements and for every need of the Airplane Industry.

Detail information and quotations on request.

Truscon Steel Company
Youngstown, Ohio

Please quote price on Hangar as follows_____
Length Width Height

☐ Please send Descriptive Folder.

Name_____

Address_____

_____

Side Slips

By ROBERT R. OSBORN

Wonder What a Pilot Thinks About?

"Why do I always win the dumb students? Here this bird is near the end of his second hour and can't even keep the ship level. That wing's been low for two minutes now. Guess I'd better bring it up myself and give him the old glare..... Sock! It came up then alright. Guess the old glare isn't what it used to be though. Couldn't scare him a bit. Sat there grinning at me. These kids! No respect for elders at all. Wasn't so long ago I could melt a windshield with my glare. Must be getting old. No pep.

"Well, no wonder. Five hours a day in these crates would take the pep out of anybody. Oh yes, says Bill, when I came back, we're going to get four new ships, with two Libertys and two D-12's. Plenty of horses, he said. And you'll get lots of cross country. And where are the ships? In the factory that's where. And what am I flying? Damjennies, that's what. All day slipping and skidding all over the sky with a lot of haywire students. Up and down. Up and down. Oh, it must be simply thrilling to be an aviator! That's what they say. Thrilling! Marvelous! Hell's Bells!

"Wonder why I chucked that chance to go in with the Old Man? Concrete contracting may not be marvelous and thrilling but it brings in the shekels. And the shekels are what we all want anyway. Well I'm making the money alright, but it's not getting in the bank: That's the trouble. Ought to be more in the bank. Never will though if I keep shooting craps with Bill. I ought to know better. Any fellow's been in the Army. Not that I'd accuse him of gyping me, but ever since that time he shot and picked up the money without looking at the dice, I've been suspicious.

"Well, this business has its advantages though. The girls still think we're super-men. Hope that little blonde is still at the field when we get down. I certainly do like the little blondes. Especially when they lisp. Bet her name is Thelma. I've got to improve my appearance though. Have to look more like an aviator. Running around in overalls all day like a plumber. Must get some riding boots and whipcord breeches. Leather coat too. That's the outfit that gets them. Hop out of the ship and swagger up and demand a cigarette. That's the way these kids do it. We do all the flying and they collect the glory. Look at this kid back here. All decked out. Even gloves. Wonder he didn't get spurs too. Staggers through a steep bank and then tells everybody he was stunting. Guess I'd better shake him around a bit. Think I'll cut the gun and see what he does. Look at that. Look at that. He'd be spinning yet if I weren't along. No use in bawling him out up here though. He's still grinning. Wait until I get him on the ground. I'll wipe that smile off alright. Can't get the right emphasis talking over my shoulder up here. Maybe my glare isn't what it used to be but I'll show him I can still talk.

"Ho hum. Such a life. Wish we'd have a couple of cyclones and a blizzard so I could get a few days off. Bet they'd want me to fly through an earthquake. Give the student landings between shocks. That's what they'd say.

"Think I'd better cut this lesson short, or that little blonde might get away. Twenty-five minutes. That's all this bird deserves. I'll tell him the oil pressure fell off. He won't know there hasn't been an instrument working in this ship for ten years. Wonder if she'll appreciate a real classy side-slip landing when she sees one?"

Foreign Aeronautical News Notes

By Special Arrangement with the Transportation Division, Bureau of Foreign and Domestic Commerce

Plan Moscow to Persia Air Service

Air service is to connect Moscow with Teheran, Persia, according to a report in a Moscow publication. Two lines would be used, the Ukrainian Co. maintaining service from the Russian city to Baku and the Junkers Co. between Pahlevi and Teheran.

During the summer season, flights between Moscow and Teheran would be scheduled, it is said, at least twice a week. It is possible to maintain service between Baku and Teheran at all seasons, but the stretch from Moscow to Baku could only be open during the summer. The new lines will permit travel between Baku and Teheran in 5 to 6 hours instead of the 3 days necessary at present.

According to agreement, the Ukraine Co. must fly a plane once a week between Moscow and Pahlevi and once from Moscow to Baku, while the Junkers Co. must fly a plane once a week between Teheran and Pahlevi and once during that time between Teheran and Baku.

New Air Lines for Roumania

First steps are being taken for the establishment of air lines between Bucharest and Prague and between Warsaw and Belgrade, following a conference in Bucharest during which definite plans were formulated. These lines will be in addition to the service maintained by the Franco-Roumaine Co.

Poland Has Winter Air Service

Polish air service is being maintained throughout the winter months, according to a report from Gilbert Redfern, assistant trade commissioner at Warsaw. Regular schedules have continued between Warsaw and Cracow, Lemberg and Danzig; between Cracow and Vienna, Lemberg and Brno, Czechoslovakia; and also on the Brno-Vienna lines by the the Aerolot Co.

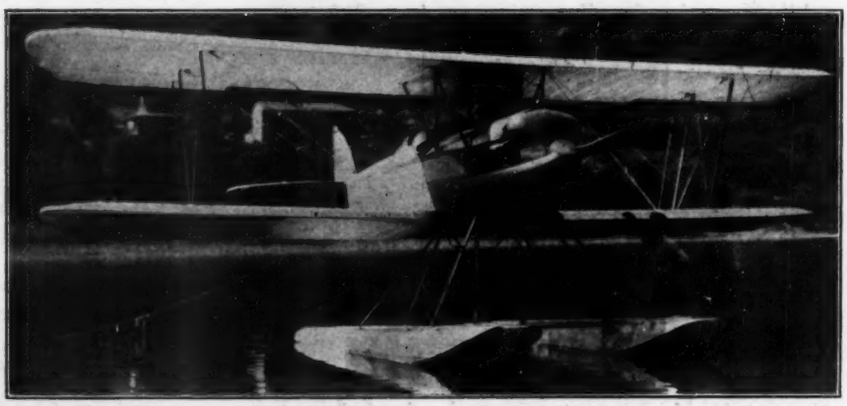
The company's report covering the month of November records 257 flights covering a distance of 43,800 mi. Passengers carried numbered 354, merchandise 49,500 lb., and mail matter 2,677 lb. During the winter, the passenger cabins are kept at a temperature ranging between 54 and 64 degrees Fahrenheit.

Nobile Plans New Transpolar Flight

Intentions of flying over the North Pole this May and landing in Canada, have been expressed by Gen. Umberto Nobile, Italian explorer and aircraft designer who accompanied Amundsen and Ellsworth over the Pole in the Norge in 1926, according to a report from Consul Gen. I. N. Linnell at Ottawa, Can. Nobile has asked the Italian Consul General at Ottawa to secure maps of the Canadian Arctic and as full information as possible concerning the territory. A dirigible would be used in the flight, which is to be purely scientific.

Edo

Pontoons and the WACO



THE old standby, the Waco 9 on Edo floats for a long time filled the need of an inexpensive, practical seaplane. On the Great Lakes, Mississippi River and in Florida and Bermuda it carried its pay load of two passengers. Never did it refuse to take-off, never did it require much care and it always served faithfully.

Now the Waco 10 equipped with the same Edo floats takes its place. Still more airworthy, still better adapted for carrying passengers, still more practical, it sets a new mark of utility for seaplanes. The waves of Atlantic Ocean are not too rough for its rugged floats, the calm waters of Allegheny River are not too smooth to take-off from. Easy to taxi, easy to fly, a good climber, and a speedy ship, it is an ideal seaplane from pilot's point of view.

The ship offers great convenience to passengers. The floats have shallow draft both at the stern and at the bow. The ship may be brought close to the beach, and passengers can step right on to the flat and wide decks of the floats. Two easy steps up the ladder and they are on the walking board of the wing. The door in the side of the fuselage lets them into the unusually wide and comfortable cockpit. Very easy to get into, it is an exceptionally pleasant ship to fly in.

More than 20 installations of Edo Floats on Waco 9 and 10 airplanes were made in 1927. Many more will be made in 1928. For pleasure flying, for commercial work or for commuting it is difficult to find a seaplane better adapted to its purpose than a Waco on Edo floats.

EDO

Edo Aircraft Corporation
College Point, L. I., N. Y.

STANDARDIZED ALL METAL SEAPLANE FLOATS

Austin Designs and Builds Aviation Buildings

AUSTIN designs, constructs and equips efficient hangars, factory buildings and other structures at *low* cost.

Austin guarantees total cost, completion date and quality of materials and workmanship.

Austin will also deliver steel and other essential materials for erection by a local builder at a decided saving in time, worry and expense.

Representative companies from coast to coast have used Austin building service.

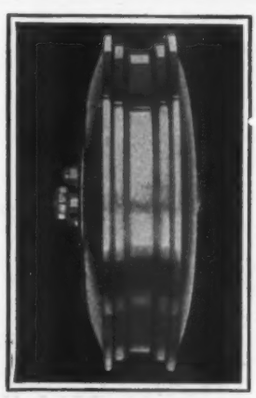
Ask for approximate costs and folder, "Austin Builds for Aviation".

THE AUSTIN COMPANY

Architects, Engineers and Builders for the Aviation Industry

CLEVELAND, OHIO

New York Cincinnati Pittsburgh St. Louis Chicago Philadelphia Seattle Portland Detroit The Austin Company of Texas: Dallas The Austin Company of California: Los Angeles and San Francisco



STRENGTH

THE actual structural strength of these wheels is far in excess of the requirements of the official hand books or of the ability of the tires used to stand, thus increasing the FACTOR OF SAFETY at a vital point. This with decreased weight.

Bendix Wheels and Brakes are now in production in standard sizes.

(Fully protected by patents and applications in U. S. and abroad)

BENDIX BRAKE COMPANY

General Offices and Plant: South Bend, Ind.

Division of Bendix Corporation, Chicago

BENDIX (4) BRAKES

FOR SAFETY

Brazil to Hold Aero Congress July 14

Brazil's first Congress of Aviation is scheduled for July 14, according to a report from Rudolf E. Schoenfield, charge d'affaires at Rio de Janeiro, to the Department of Commerce, Washington, D. C. The initiative of two Brazilian flying clubs, the Club dos Baneirantes de Brazil and the Brazilian Aero Club, did much toward making the necessary arrangements for the congress.

The official program is nearly complete and is to include discussion of landing fields, air traffic, aeronautical technique, plans and aid for the advancement of aviation, training of pilots, aviation law, and national administrative organization of aeronautics.

Make Large Aerial Survey in Canada

One of the largest aerial surveys ever undertaken is now being finished in Saskatchewan, Canada, according to reports. The survey is being made of Wood Buffalo Park, a tract extending 175 mi. north and south and 150 mi. east and west.

The work is being done with two seaplanes, each carrying a pilot, a photographer, and a surveyor-navigator, which operate from a base at Ladder Lake, Saskatchewan. Photographs taken at a height of 5,000 ft. show considerable detail and characteristics of the area, much of which has never been visited by man.

Soviet Air Traffic Increases

Airplanes of the Soviet Union commercial air fleet made 2,392 trips during the past year carrying 6,977 passengers and more than 176 tons of freight and mail, according to a bulletin received by the Soviet Union Information Bureau, Washington, D. C. With a total of 1,122,687 mi. covered in the various flights, the Union reports that mileage and number of trips have increased six-fold since 1923, while number of passengers has increased seven-fold. The Soviet lines are run by the German-Russian Aviation Co., the Volunteer Air Fleet, and the Ukrainian Air Transport Co.

To Use Moths in New Bahama Service

Plans are now complete for air service between Palm Beach, Fla., and Grand Bahama in the island group of that name, according to announcements. Two Royal Air Force pilots recently arrived from England with two De Havilland Moth seaplanes which are to be used in the air line.

The service has been arranged in connection with the Grand Bahama Development scheme in which prominent American and English financiers have taken an interest.

New Line Between Germany and Italy

Opening of an air line between Milan and Monaco, Bavaria, has been scheduled for April 15, according to a decision reached between Under-Secretary of State Balbo, Italy, and the German Ministry of Communications.

Until July 1, however, the line is to be used only experimentally in order to study meteorological conditions existing in the country to be traversed. Mail will be carried during this stage of development, while passenger service will open July 1.

Planes May Carry African Gold

African gold may be carried by air, according to an officer of one of the large mining companies. Shipments of gold bullion weighing 390 tons were moved at what was said to be an expense of $1,822,500 during 1926, and it is estimated that a saving of $486,000 in interest, insurance, and sundry expense may be made if the precious metal is transported by air.

AIRPORTS AND AIRWAYS

Portland, Ore.

By John W. Anderson

The Aeronautical Pursuits Corporation has announced its entry into the aerial photography field. The company plans to operate its own darkroom, laboratory, drafting room and airport. Travel Air planes will be used. Complete aerial photography equipment has arrived.

Mrs. Basil Russell, wife of Basil Russell, well known local pilot, has been taking lessons from her husband for several months and expects to solo before long. Russell declares his wife to be a very apt pupil.

A 50 hr. flying course has been started by the Rankin School of Flying. It will be open only to students graduated from the regular Rankin course and is designed to enable student fliers to obtain all the air hours called for by commercial pilots' licenses.

Rankin pupils are now issuing a monthly paper entitled *Tale Spins*. It is edited by Walt Bohrer and Faye Carter, the first girl student to enroll.

W. E. Hazelwood, former Army pilot at Kelly Field, Tex., has been retained as flying instructor by the Pacific Airplane Service of Salem, Ore.

F. C. Maddox of Wenatchee, Wash., has been appointed Waco agent for the state of Washington by Tex Rankin, holder of the sale franchise for Oregon and Washington. Maddox plans to open an air taxi service and a flying school there.

Elect Sidney Peters Club President

Sidney Peters, former Army flier, was elected president of the Aero Club of Oregon, local chapter of the National Aeronautic Association, at a recent meeting. He succeeds L. L. Adcox, head of the Adcox Auto and Aviation School.

Other new officers are Basil Smith, vice-president; Charles Echols, secretary, Hal Bennett, treasurer, and L. E. Therkelson, Julius L. Meier, Tex Rankin, L. L. Adcox and Arthur Mackenzie, members of the board of directors. Other retiring officers were Arthur Mackenzie, vice-president, Kenneth Jordan, secretary, Paul Brong, secretary, and Noel B. Evans, Basil Smith, James Rinehart, and L. E. Therkelson, directors. Mayor George L. Baker and Tex Rankin were principal speakers at the meeting.

R. N. Goff, R. D. Davis and A. W. Davis of the Mackenzie-Goff Aviation Company, recently made a trip to Bend, in central Oregon, to establish a branch of their American Eagle plane agency and flying school.

Pearl Sullivan, Portland girl, is the most recent woman student in a local aviation school. She is enrolled in the Hill Aero School.

The Bell Line Air Service, Eaglerock distributor, has moved into spacious new quarters at 11 North Broadway. A large biplane, scheduled to arrive soon, will be placed in the show windows.

Students in the Rankin School of Flying now number over 200, according to J. Kegerreis, manager of Rankin Flying Service, Inc., of which the school is a branch. At the rate the classes are growing the school will soon be the largest in the country, he believes.

The Hill Aeronautical School's second class of 25 students has begun its instruction. The first class is now well along in its course. Officials plan to make the course one of the most comprehensive in the country, they say. Arrangements have been made to outfit the ground school with several types of engines, instruments, and other flying equipment. Old model planes will be obtained for use in instructing pupils in rigging, flying fabrics, and doping. There are 70 lectures on the present curriculum.

Lieut. Art Mackenzie, Army Air Reserve, was commissioned by a Portland power company to stand by during a recent snow storm to shoot trouble on its lines. His job was to follow the lines carrying a photographer who would photograph and otherwise locate breaks. He is president of the Mackenzie-Goff Aviation Co., and flies a powerful little Eagle plane.

Melvin Ellison, former radio operator on the transcontinental air mail route, is now employed by the Pacific Air Transport Co. with headquarters at Vancouver, Wash.

Charles Langmarck and Elbert Parminster, Oregon aviators, recently started an aeronautical school near the Oregon Agricultural College campus in Corvallis, Ore. The school is not connected with the college but many of its pupils are expected to come from the campus. Parminter recently bought a Waco 9 from the Rankin Flying Service in Portland. Langmarck is the instructor. He is a licensed pilot with about eight years of experience. The school started with 10 students.

Thousands have stopped before the windows of the C. L. Boss Automobile Co., Portland, Ore., to view this Waco 10 put on exhibition. The plane is one consigned to the Rankin School of Flying in that city.

R. S. Davis, R. D. Goff and A. W. Davis of the Mackenzie-Goff Aviation Co. flew to Bend, Ore., recently when the Columbia River highway, the only road from Portland to the central Oregon city, was snowbound. The company plans to open a branch school and American Eagle agency in Bend.

Clarence H. Farnham, president of the Aeronautical Pursuits Corporation, local Travel Air distributor, has just returned from a conference of Pacific coast Travel Air sales representatives at San Francisco.

A carload of Waco 10 planes, recently delivered to the Rankin Flying Service, Inc., here did not last a week. The

Complete course in Aeronautical Meteorology

THIS course covers those features of the atmosphere which are important in its use as a flying medium. The composition and physical character of the atmosphere at various altitudes is studied. Also changes of temperature and pressure, and their results; primary and secondary circulation systems; precipitation in its various forms; weather and its peculiarities; climatic zones and their characteristics; and recording instruments and their use.

Part of this course comprises a practical application of the above features of flying, and in laying out and following air routes in different latitudes, and in various seasons.

A study of topography will be included in the course, as it is an essential toward understanding the helps and hindrances in land formation in the handling of aircraft. Included with this part of the course will be problems in buoyancy, wind effects, visibility, and such other factors as are of special importance.

The lectures will be illustrated by weather maps, pilot charts, and other suitable material, and the facilities afforded by the local Weather Bureau station will be freely consulted. Frequently eminent specialists in aeronautics will address the class in relation to particular features of their work.

The course starts February 16th at 32 Waverly Place, 8 P.M. For information address Collins P. Bliss, Acting Director, Evening Engineering Division.

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Navigation Lights

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five planes were gone almost before the dealer knew it. Another carload is now due. Two of the planes went to the Pacific Airplane Co., Salem, Ore., and one each to Nick Mamer, Spokane, Wash., F. C. Maddox, Centralia, Wash., and Gordon Sherbeck, Portland.

Teaching folk to fly is almost as thrilling as service in the World War, according to Art Walters, instructor in the Rankin School of Flying. Walters holds the Distinguished Service Cross and the Croix de Guerre with gold star. He was not a flier during the war but he was active on seven fronts and was picked by General Pershing as one of the 100 outstanding heroes of the A.E.F.

"It's quite thrilling to realize that you're turning out a successful pilot," Walters said. "When I solo a student, I experience a tremendous amount of gratification". Walters was taught to fly by Tex Rankin, head of the school, in 1922. He has operated schools of his own since in Idaho.

Tex Rankin, who holds the Waco franchise in Oregon and Washington, made a recent tour of his branch agencies by air. Centralia, Spokane, Seattle, Tacoma and Olympia, Wash., were on his itinerary.

Airways Inspector Visits Gorge Route

A. P. Taliaferro, airways inspector for the United States Department of Commerce, recently was given his first glimpse of the Columbia gorge airway reaching through the Cascade mountains east of Portland. Tex Rankin took Taliaferro to The Dalles, Ore., and back in his Whirlwind Waco.

Rankin kept the plane only about 100 ft. off the Columbia River during the flight to enable Taliaferro to look for suitable sites for emergency landing fields. Taliaferro unofficially expressed satisfaction with gorge as an eastern airway. For several years the Portland chamber of commerce, Port of Portland, other officials and local fliers have been seeking official recognition of the route. They see possibility of its gaining recognition as a result of the inspector's flight.

Taliaferro is making a preliminary survey of the proposed official airway between Portland and Seattle. His work will lead toward establishment of a fixed route with lighted landing fields every 30 mi.

Two new pupils of the Hill Aeronautical Club of Portland, Ore., took no chances on an occasion last month. They made out their applications for enrollment and were all ready to sign their names when one of them discovered that the date was Friday, the thirteenth. He nudged the other. Both laid down their pens. They signed up on Jan. 14.

Philadelphia, Pa.

By Ray Krimm

Several hundred National Guardsmen, regular Army officers, interested civilians, and families and friends of the Guardsmen watched the 28th Division Air Service, Pennsylvania National Guard, burn its seven condemned JNS-1 planes recently.

The burning was staged at the Philadelphia Airport, Island Road below Tinicum Avenue, in front of the two large hangars of the Air Service. The Wright Hispano engines, instruments, wheels, propellers and tires of the doomed planes were salvaged. The insignias and numbers were cut from the wings of the seven planes and hung on the walls of the trophy room of the 103rd Observation Squadron.

The seven planes were stacked in one pile 30 ft. in height, tied together, and deluged with gasoline and oil. When the match was applied a sheet of flame 90 ft. high rolled toward the sky. Maj. J. Sydney Owens, commanding the Air Service, outlined the service the "Jennies" had given during the World War. Lieut. Earl J. Carpenter, U. S. Army Air

Corps, an instructor assigned to the Air Service here, acted as master of ceremonies.

The 28th Division Air Service has received two Consolidated PT-1s to temporarily replace the "Jennies" that were destroyed, pending the arrival of eight new planes at the Philadelphia Airport. The PT-1s are being used for primary training. They were brought here from the Middletown, Pa., Air Depot by Major Owens and Capt. George N. Hyland, operations officer.

The Division expects to receive three Curtiss O-11 Falcons, with Liberty engines, next month. It also is to get five advanced training planes later in the year.

The suggestion of Hollinshead N. Taylor, president of the Philadelphia chapter of the National Aeronautic Association, that his organization be merged with the Aero Club of Pennsylvania has been endorsed by R. Sanford Saltus, Jr., president of the Aero Club. The question will be submitted to a joint meeting of the two organizations at the Engineers' Club on Jan. 31. The merger is expected to be unanimously approved.

The sale of a new Waco 10 at the Philadelphia Airport recently to Raymond Ott of Elkton, Md., disclosed that the Ludington Philadelphia Flying Service, lessee of the airport, has been averaging a Waco sale each week for the last two months.

Eight Sales in Eight Weeks

Eight Waco 10s have been sold at the airport in eight weeks, R. Sanford Saltus, Jr., vice-president of the Ludington organization, announced. The company also has acted as agent in selling second-hand planes for their customers.

Charles Townsend Ludington, president of the Ludington Philadelphia Flying Service, will forget business cares for the next three months in Florida. He recently left for Cocoanut Grove in that state for an extended rest.

The United Flying Club, Philadelphia's newest aviation organization, has opened offices at 1011 Chestnut St. R. O. Krause is president, Howard W. French is chief instructor and vice-president, E. J. Roberts is secretary and treasurer, and W. T. Carlton is listed as the club's aerial photographer. The club expects delivery on a new dual control Eaglerock about Feb. 1. The organization will specialize in flying instruction.

Among the recent Philadelphia Airport visitors was Pilot Johnson of the Marshall Flying School, Marshall, Mo., who flew a Standard here. J. H. Rand of the card index company, flew his tri-engined Ford to the airport from New York and after remaining here four days took off for Baltimore. While here he made numerous daily flights over the city, with members of the firm and customers as guests.

Maj. J. Sydney Owens, commander of the 28th Division Air Service, Pennsylvania National Guard, has announced the enlistment of Edward E. Felker of Beaver Springs, Pa., president of the University of Pennsylvania Aero Club.

Pittsburgh, Pa.

By Ray A. Tucker

The Sixth Annual Aviation Ball of the Aero Club of Pittsburgh was held on Friday evening, Feb. 3, in the Ball Room of the William Penn Hotel. This event has grown to be one of the outstanding features of the social season in Pittsburgh. The proceeds of the Ball are used for the promotion of local aeronautics, such as defraying expenses for the boys' model contest, air meets, and speakers bureau. Capt. Thomas S. Voss, commanding officer of Rodgers Field, the Pittsburgh Municipal Airport, was chairman of the ball committee and was assisted by Lieut. Col. James M. Magee, Air Corps Reserve, as chairman of the patroness committee. The presence of many outstanding aviation celebrities as honored guests

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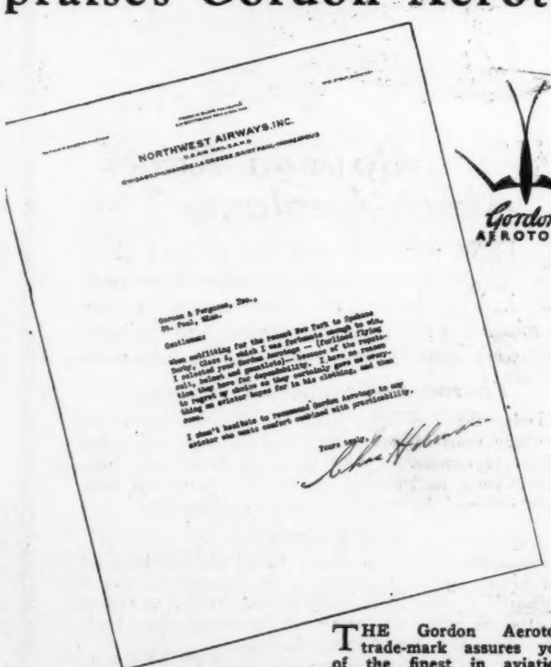
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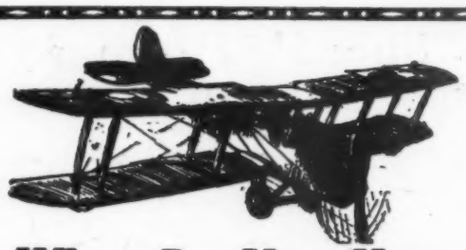

What Do You Know About Airplanes?

A FEW years ago men had to learn about aircraft from personal, costly experience. They had no one to guide them—no one to point out mistakes when they were made—and therefore years were spent learning what takes months now.

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St. Louis, Mo.

By M. L. Alexander

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Of the bill's appropriation, $40,000 is available for lighting and grading the field of 246 acres. One of the early projects is to be the construction of runways so that planes may have no trouble in getting on and off the field during the heavy spring thaws. Experiments are being made to determine the best type of facing for the runways, which probably will be macadamized instead of having the usual cinder covering. The runways are to be laid out so that they may be incorporated in the improvements of the larger field if the voters pass the proposed $1,000,000 bond issue next November for the enlargement and permanent acquisition of the airdrome.

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Just what effect the acquisition of the field by the city will have on its operation is a subject of speculation among fliers. For the past four years O. E. Scott has been in charge of the airdrome, deriving his pay from rentals for hangar space paid by the various fliers. Scott's appointment comes, however, from Maj. Albert Bond Lambert, who under the terms of the proposed airport ordinance, will rent 176 acres of the field to the city at $1.00 a year and lease the balance for $10,000, the latter figure being applicable as a first purchase payment when the city decides to buy the airdrome.

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This speed was made possible by a heavy tail wind, estimated to have had a velocity of 50 m.p.h. at 1500 ft. Just before Gurney took off a flying student of the Parks Airlines, in a Standard climbed to 1500 ft. and throttling his engine down held his plane virtually motionless over the field for three or four minutes, the wind driving his plane backwards as fast as its engine carried it forward.

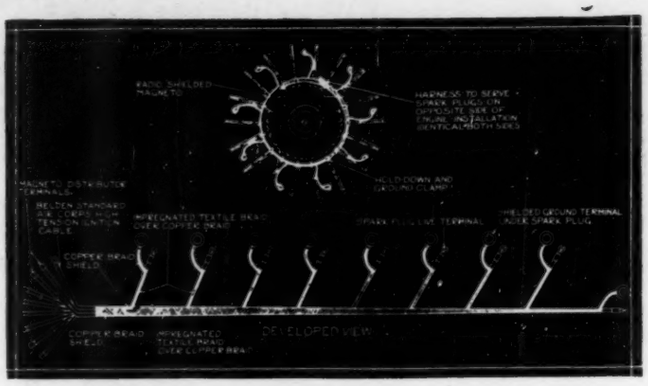
Leslie H. Smith, one of Gurney's flying mates, gave mechanics a severe problem when he was forced to bring his DH down on an island in the Mississippi River across from Alton on the southbound trip. His main gasoline tank ran dry as he crossed the river, and he was flying so low, because of bad visibility, that he was forced to come down rather than attempt to cut in his reserve tank. Although he was over water at the time he managed to get down on the island in such a tight space that there was no possibility of flying the plane out again. The plane was recovered later after some work.

Springfield, Mass.

By Charles Hanson Gale

Municipal airport prospects for Springfield have been alternatively bright and dark in recent weeks. The ebb and flow of official opinion on the airport have centered around the new chairman of the city airport committee who took office in January. Controversy was precipitated by his statement that a waiting policy was desirable in order to make sure that all considerations were fully studied before assuming the expense of a municipal airport. It was declared further that the three operating companies in town had their own airports and that a municipal airport was therefore unnecessary.

In view of these points, he further stated that he saw no need of calling a meeting of the city airport committee until spring. Protest met this announcement, however, and it was



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Mail Pilot Makes Fast Time

Flying to Chicago with the mail, from St. Louis the same day, Pilot Gurney took off from Lambert-St. Louis Field at 4:20 P.M. and landed at the Chicago Field at 6:10 making what is believed to be a record speed run for the 280 mi. mail route. Subtracting ten minutes for the two five-minute stops at Springfield and Peoria, he made the trip in 1 hr. 40 min., averaging 168 m.p.h., or 2.8 mi. a minute.

This speed was made possible by a heavy tail wind, estimated to have had a velocity of 50 m.p.h. at 1500 ft. Just before Gurney took off a flying student of the Parks Airlines, in a Standard climbed to 1500 ft. and throttling his engine down held his plane virtually motionless over the field for three or four minutes, the wind driving his plane backwards as fast as its engine carried it forward.

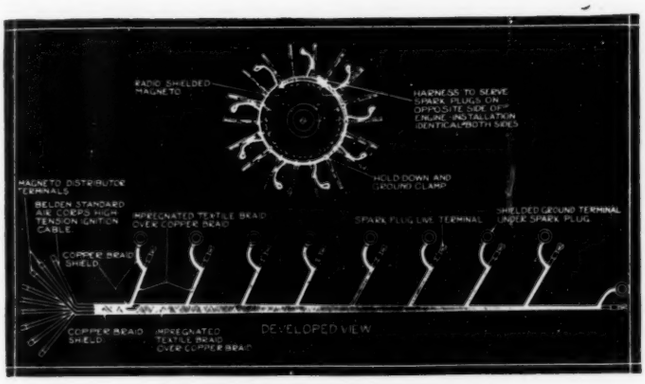
Leslie H. Smith, one of Gurney's flying mates, gave mechanics a severe problem when he was forced to bring his DH down on an island in the Mississippi River across from Alton on the southbound trip. His main gasoline tank ran dry as he crossed the river, and he was flying so low, because of bad visibility, that he was forced to come down rather than attempt to cut in his reserve tank. Although he was over water at the time he managed to get down on the island in such a tight space that there was no possibility of flying the plane out again. The plane was recovered later after some work.

Springfield, Mass.

By Charles Hanson Gale

Municipal airport prospects for Springfield have been alternatively bright and dark in recent weeks. The ebb and flow of official opinion on the airport have centered around the new chairman of the city airport committee who took office in January. Controversy was precipitated by his statement that a waiting policy was desirable in order to make sure that all considerations were fully studied before assuming the expense of a municipal airport. It was declared further that the three operating companies in town had their own airports and that a municipal airport was therefore unnecessary.

In view of these points, he further stated that he saw no need of calling a meeting of the city airport committee until spring. Protest met this announcement, however, and it was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decided that an earlier meeting was necessary.

There has been no united effort in the interest of the municipal airport by the aviation boosters of the city, but a meeting was planned which would attempt to unite members of all the operating companies and others backing the municipal airport project in order to reach an agreement and present a united front to the city authorities.

The failure of action in the airport matter has caused considerable alarm among the flying men of the city as the delay has practically meant that an airport is out of the question for this year. The city will have to depend for the time being upon the private flying fields. These are not equipped with hangars for visiting planes and there are no night flying facilities. Lack of proper accommodations has meant the dropping of practically all flying here until spring.

Harry Hermann, encouraged by the warm weather here early in January, sold a Swallow to the L & H Aircraft Co. of Hartford, Conn. Harry trucked the plane to Brainard Field, Hartford, and set it up. A test flight followed.

Warm Weather Tempts Him Out

James A. Hearn, pilot of Massachusetts Airways, had expected to stay on the ground until spring but was tempted by the warm weather and undertook the first flight of a local company to be made over the city in 1928. He took a student with him.

Massachusetts Airways recently announced that it had been granted the Eastern Canada agency for the Eaglerock. The company is now a wide distributor in New England. Extensive sale promotion plans are being made by the company in anticipation of a brisk business in the spring. Agents are being appointed according to districts and about six have been announced. These include an agent at Providence, R. I., Northampton and Boston.

The first graduation exercises of the Springfield Ground School were held recently. The class started in the fall on engine work and later advanced to airplane study. About 20 men completed the course.

Diplomas were granted by Lieut. Elzor Hall, head of the school and formerly instructor in a course in aeronautics in the University of California extension department. The ground school has been very successful under his leadership.

More than 20 men applied for the new class which started, while a group of about 15 advanced from the engine work to the airplane section. The school has considerable equipment in engines and airplane parts.

The first monthly meeting of the Aircrafters, a new flying club organized here of members and graduates of the Springfield Ground School, was held in connection with the graduation. A banquet was also held.

Hartford, Conn.

By B. A. Pollet

Lieut. Carl A. Dixon and Lieut. Charles Wright, both members of the 43rd Observation Squadron Connecticut National Guard, have joined the L & H Aircraft as pilots and teachers to assist Lieut. Osmond M. Mather. Charles Arnold, mechanic with the L & H, has also qualified as pilot and passed his examination for the state's license under the inspection of Lieut. Harry Generous of the Aviation Commissioner's office.

Two more new hangars are almost completed and the New England Aircraft Corp. and the L & H Aircraft are expected to move into their new quarters soon. The hangars are almost identical in size and face the recently acquired land to the south of the present field. In the meantime the Municipal Hangar, which heretofore has been let free to all pilots, will be rented to an operating company who in turn will rent space the company will not need. It is expected that the Interstate Airways will take over this project inasmuch

as they are not contemplating the construction of a hangar of their own at this time.

The L & H Aircraft has taken the sales agency for the "Challenger" biplane and will have New England and western New York as its territory.

Among the recent visitors was Bernt Balchen flying one of the Wasp-engined Fokker Universals. He arrived accompanied by several passengers; later he visited the Pratt and Whitney Aircraft factory in this city where the "Wasp" engine is manufactured. The 20 ordered by the Fokker Aeroplane Mfg. Co. are to be used mostly for its new tri-engined transports now being built in Wheeling, W. Va.

Lieut. Stevens A. McClellan of the Pratt and Whitney Aircraft Co., has been called into active duty by the United States Marine Corps and is now flying in Nicaragua. The change was made by special arrangement with the War Department in order that the Pratt and Whitney Co. might have an opportunity to observe its engines now being used by the Army and Navy under actual service conditions in the Tropics. Lieut. William B. Wheatley, Pratt and Whitney test pilot, is at McCook Field servicing the "Hornets" recently sold to the U. S. Army.

In spite of the advanced season, there is still considerable flying being done at Brainard Field, the lack of snow being of course responsible for this fact. Some seventy students keep the field busy during the week and Sunday visitors provide some opportunity for hopping.

Howard Stark and C. P. Oleson now maintain the mail route of the Colonial Air Transport Co. and are hanging up record runs with their new Pitcairn Mailwings. A run of 1 hr. 45 min. from Hadley to Boston including a stop at Hartford has been recorded.

Denver, Colo.

Establishment of an independent commercial airport has been begun here by the Denver Union Airport, Inc., a subsidiary of the Rocky Mountain Airlines, Inc. The site chosen is north of Lowry Field and is of 281 acres in area. O. E. Brueggeman, builder of Brooks Field at San Antonio, Texas, heads the company.

The location is remarkably suitable for a field, it is said, because practically the entire acreage is naturally level and immediately available, therefore, for an airport. Since the field will easily accommodate four 2500 ft. runways in any desired direction, is clear of obstructions, and is located on a main boulevard four and one-half miles from the post office in the center of the Denver business section, it is thought to have everything in its favor for class A classification.

A steel hangar is to be constructed on the new field, and Rocky Mountain Airlines equipment is to be moved to the airport.

Directors of the Denver Union Airport, Inc., include Paul B. Lanius, Charles R. Enos, W. H. Edmunds, George Cutting and James D. Hill. These men are also directors of the Rocky Mountain Airlines, Inc.

Club and School Organized

Men in the aforementioned group recently organized the Mile High Aviation School, Inc., and also the Mile High Flying Club. The latter organization is planning to build a clubhouse at the new airport of Spanish architecture with a flat and glass sections enabling those inside to observe the flying activity without. The club also plans the purchase of several light planes. An experineced pilot will be put in charge and will give instructions in flying.

According to present arrangements, the club will be in three divisions. The first will include students, the second pilots with experience, and the third associate members who wish to spend time in the air as passengers. The plan is similar

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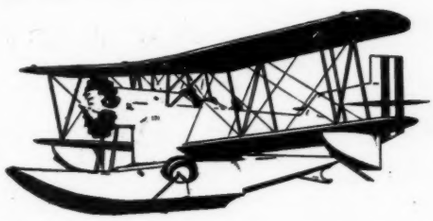

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Lincoln - Page

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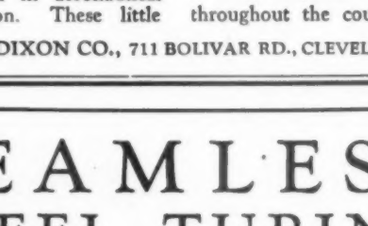

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to that successfully followed in the Powder River Flying Club at Casper, Wyo.

Paul B. Lanius, Charles R. Enos, and Stanley H. Ferguson were instrumental in the organization of this club. Others taking active interest are George H. Shaw, Mark J. Bennett, Charles Boettcher, II, Norman Barwise, Theodore Chisholm, W. L. Taylor, Emerson B. Evans, C. Robert Kiefer, John Loiseau, W. Van Horne Black, C. J. Niehaus, Lou K. Brown, P. W. Boeren, Lou Goldberg, John Nylen and Emile Paulsen.

Women members are eligible for the new club. Mrs. Charles R. Enos has already taken several flying lessons.

Detroit, Mich.

By John T. Nevill

A dinner in honor of Harry Brooks, the pilot who flew Mrs. Evangeline L. Lindbergh to Mexico City to visit her son, Col. Charles A. Lindbergh, was held recently at the Oakland Hills Country Club, Birmingham.

William B. Stout, general manager of the airplane division, Ford Motor Co., and designer of the Stout all-metal monoplane in which the trip was made, was the principal speaker of the evening. Mr. and Mrs. Henry Ford, Mr. and Mrs. Edsel Ford, Mrs. Lindbergh and William B. Mayo, chief engineer of the Ford Motor Co., were present.

Brooks is 25 years old and has been a pilot for about five years. He was presented with a silver trophy by Clarence Vliet, superintendent of Birmingham schools, from which Brooks graduated seven years ago.

M. H. Pettit, vice-president of the Nash Motor Car Co., M. C. Meigs, publisher of the Chicago Herald and Examiner, and C. C. Allen, of that city made a flying trip to Detroit recently to have luncheon with Henry Ford. Following the luncheon the party was taken for a short flight over Dearborn by Eddie Stinson, after which they took off for the return to Chicago. The trip was made in a Ford tri-engined monoplane belonging to the Standard Oil Co.

B. G. Dahlberg, president of the Celotex Co. of Chicago, has purchased his second Stinson biplane, the Stinson Aircraft Corp. announced recently. The new plane is to be kept in Clewiston, Fla., where the Celotex Co. has large holdings, it was said. Mr. Dahlberg uses his first purchased Stinson traveling between Chicago, New York and Florida.

William A. Mara, secretary of the Stinson Aircraft Corp., returned recently from Tulsa, Okla., where he delivered a Stinson plane to C. A. McIntyre, who plans to use it in his air taxi service.

Atlanta, Ga.

By John K. Ottley, Jr.

The Atlanta & Lowry National Bank of Atlanta will shortly put in operation the first privately owned revolving beacon in the state, according to an announcement by Robert F. Maddox, chairman of the board of directors. The 8,000,000 candle power beacon will flash its signal of guidance from a 100 ft. steel tower atop the bank building.

A Pitcairn Orowing equipped with a Curtiss K-6 engine and piloted by Johnny Kytle, who will fly one of the Atlanta-New York mail planes, set a new record of 3 hr. 45 min. between Daytona Beach, Fla., and Atlanta with pictures of President Coolidge and the Pan-American convention in Havana, Cuba. The films were shown in an Atlanta theatre on the evening of the plane's arrival, within 24 hr. of the time of President Coolidge's arrival in Havana.

Flown from Havana to Key West, Fla., the films were transported by train to Daytona and picked up there by the Pitcairn plane for a non-stop trip to Atlanta. An extra tank containing 35 gal. of gasoline enabled Kytle to make non-stop flights each way over the 400 mi. course between Atlanta and Daytona.

Cincinnati, O.

By Charles E. Planck

"Learn to fly, buy a plane, and fly it home" is not only an advertising slogan of the Embry-Riddle Flying School, but the words of one of its students who recently did just that.

George Stone Cary, who was born in Cincinnati, now lives in Torrington, Conn.; but when he decided to learn to fly, he came back to Cincinnati.

When he left Torrington, he told nobody where he was going, save his wife. At Lunken Airport he declared his name was not to be published as a student. He was a mysterious character until he shoved off alone in his new Waco 10 for Torrington. It seems he had a purpose.

George S. Carey. He flew home and surprised the town.

When he had received delivery on his plane, Cary flew 13 hr. about the field, shooting landings at a mark, in preparation for the "pocket handkerchief" fields of his own New England. Then Inspector Cuttrel of the Department of Commerce gave him his examination for a private license and he passed. Two days later, the weather being good, he took off for Columbus.

Before he left the field, serious young New Englander that he is, confided that all his secrecy was maintained just for the sake of surprising the folks at home. His wife did not know he was flying home, nor did anybody in the old home town.

Cleveland, Ohio

Colonial Western Airways started operation recently of a daily schedule between Buffalo and Cleveland using a Fairchild cabin plane of their own and a Laird and Stinson belonging to the Thompson Aeronautical Corp.

The National Guard will begin construction of their hangar on the south side of the Cleveland Airport about Feb. 1. It is to be a modern hangar in every respect, with showers, officers' quarters, and other conveniences. Cleveland is to be congratulated on having a well equipped National Guard unit. Its members have been flying their PT's every day, despite extreme cold and heavy snows.

The Stout Airway, operating between here and Detroit with Ford three-engine planes, reports excellent patronage. The schedule of two flights a day in each direction has been maintained consistently.

The Thompson Aeronautical Corp. has found that inclement weather has not lessened the popularity of sight-seeing tours over Cleveland in the Stinson monoplane. Moreover, a surprising number of people have passed through the city by air this winter, it being a rare day that does not see at least one visitor landing at the port.

Pilot George Haldeman and Ruth Elder were frequent visitors to the field during the first part of January. Each commented on the splendid condition of the field.

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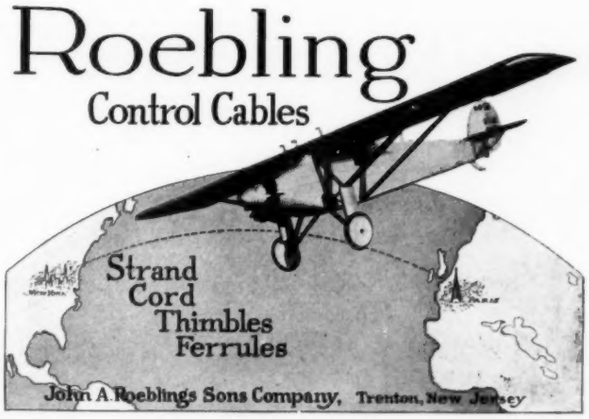

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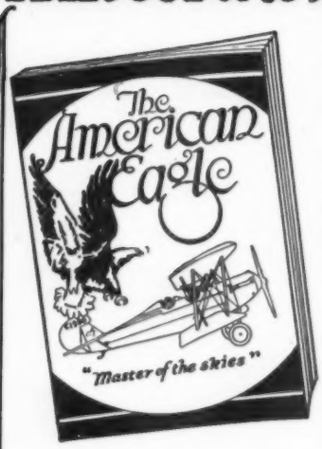

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UNITED STATES AIR FORCES

Army Air Corps Cadets are Named

Army Air Corps cadet appointments of 127 young men from civil life was recently announced by the War Department. These men are first to be enlisted at military stations near their homes and later to report to the commandants of the primary flying school to which they are assigned. Brooks Field, San Antonio, Texas, will receive 61 cadets, while March Field, Riverside, Calif., will receive the remaining 66.

The assignments follow:

BROOKS FIELD

ALABAMA—Stanley Dunn and Thomas L. Mosley.
ARKANSAS—James W. McCauley and Robert R. Riggins.
DISTRICT OF COLUMBIA—Reginald F. C. Vance.
FLORIDA—William C. Davis, William D. Matthews, V. A. Pope, Thurston Ritter and Ralph T. Wear.
GEORGIA—Spencer Callaway, Robert D. Kingman, Charles C. Little, John E. McCullough and Eugene H. White.
LOUISIANA—Richard V. Conover.
MASSACHUSETTS—Robert Anthony Cliffe, Bert C. Riley, Jr., Richard C. Shaw and J. Chesley Stewart.
MARYLAND—Roswell R. Boyer.
MISSISSIPPI—H. S. Godwin.
MISSOURI—Flint Garrison, Jr., Robert C. Luckey, Nicholas A. Laurenzana, Millard F. Tindall and Murl Estes.
NEW YORK—William T. Colman of Dunkirk and Morley F. Slaght of Buffalo.
NEW JERSEY—James C. Long of Atlantic City.
NORTH CAROLINA—Philip H. Atkinson, Lester Y. Haynes and Edwin Lee Tucker.
OKLAHOMA—Russell Martin.
PENNSYLVANIA—Thomas E. Briggs, Wells H. Denney, James H. Gregg, Augustine C. Haller, Jack F. Harris, John W. Mead, Frank E. Rowe, George E. Rote and William C. Wonders.
SOUTH CAROLINA—Thad Edgar Horton, Charles Pinckney Layton, John W Maxwell and Robert M. Saverance.
TENNESSEE—Claude R. Love.
TEXAS—Artas H. Boettcher, H. T. Edward Hertzberg, D. Frank Carden, Jr., Edmund P. Harris, Garland M. Lasater, William Lecel Lee, John Robert McDariel, William E. Nettle, Marshall N. Ney and John T. Williams, Jr.
VIRGINIA—Frank Armstrong, Jr. and C. Weston Goode.

MARCH FIELD

ARIZONA—Ernest A. Littlefield, Allen J. Mickle, George B. Peck and Harry Arthur Saunders.
CALIFORNIA—Milton H. Anderson, Robert Bruce, Haywood S. Hansell, Jr., Clarence Parham, Kenneth C. Brown, J. Harold Bundy, Lanelle B. Craig, T. J. Meyer, Harry E. Gilmore, Wallace G. Lentz, Donald M. McCree, Edward G. Mason, Lee Sandfort, J. Arthur Ronin and J. M. Wilson.
COLORADO—George E. Kinzie.
IDAHO—Eugene V. Cole.
ILLINOIS—Frank Eugene Quindry, J. H. Roman, John C. Schuller and James Lyla Sullivan.
INDIANA—Otis F. Bryan and Harley Ray Grater.
IOWA—Harry E. Campbell and Jesse C. Skow.
KANSAS—Raymond L. Winn and Jack W. Wood.
MICHIGAN—Sam H Bensky, Durwood O. Lowry, John Stanley Harvey, Herbert J. Kline, Henry W. Meyer and Oswald Robbins.
MONTANA—Wallace Terhel.
NEBRASKA—Chares Hedges, Chester T. Isgrig and Horace J. Reid.
MINNESOTA—Marcus J. Maher.
NEW MEXICO—Gilbert I. Rippin.
OHIO—Nelson W. Burch, Will J. Butzberger, Robert H. Clarke, Harold C. Darling, Carl Fitzpatrick, John K. Frye, Jr., Ralph T. Jonson, Robert F. Lane, Samuel R. Spiker and Robert M. Wilson.
OREGON—Ivan D. Houston, John P. Kenney, Walter D. Olson and George H. Pfeuffer.
UTAH—Harold M. Reherd.
WASHINGTON—M. E. Preston.
WEST VIRGINIA—A. B. Osborn and George Wiles, Jr.
WISCONSIN—Truman H Marsh, William A. Matheny, Edward J. Page and Frank W. Raymond.
WYOMING—Harry M. Folmer.

Introduce Two Aeronautical Bills

A bill to increase the efficiency of the Air Corps of the Army was recently introduced simultaneously by Senator Robinson of Arkansas and Representative Dickstein of New York in the Senate and House, respectively. Representative Vinson of Georgia has also lately introduced a bill toward the same end which calls for the amending of former acts relative to the national defense.

The first mentioned bill calls for a special promotion list based on length of commissioned service and says in part:

".... Air Corps officers below the grade of colonel shall be promoted to the grade of lieutenant when credited with

three years' commissioned service; to the grade of captain after seven years' commissioned service; to the grade of major after 12 yr. of commissioned service; to the grade of lieutenant colonel after 18 yr. of commissioned service; and to the grade of colonel after 25 yr. of commissioned service." Exceptions are provided in order to maintain the correct per cent. of officers.

Representative Vinson's bill provides for purchase abroad or in the United States of aircraft designs, parts, and accessories at the discretion of the Secretary of War or the Secretary of the Navy according to the judgments of the secretaries in the interests of increased efficiency in the air.

Small Bombs Sink Manari

Striking evidence of the vulnerability of merchant shipping was given recently, according to Air Corps officers, when 25 lb. bombs alone were needed to sink the obsolete 5,000 ton steamship *Manari* in practice maneuvers off Panama. The small fragmentation bombs usually employed against ground troops were used under the theory of driving away the anti-aircraft gun crews before the arrival of the large bombing planes with their 100 lb. "eggs". Long before the arrival of the latter, however, the *Manari* listed heavily and sank.

Planes of the 24th Pursuit Squadron were responsible for the destruction of the ship, which in the opinion of officials indicates many possibilities in the field of attack from the air against merchant craft employed in military service.

Supply Plane in Nicaragua Invaluable

Importance of the airplane in Nicaragua was recently outlined by Major Brainard of the Bureau of Aeronautics, Navy Department, Washington, D. C. The major described the conditions under which operations were being carried on and the serious difficulties encountered.

The only means of maintaining men in the field, said Major Brainard, is by bull train which takes from three to five weeks to get rations to the base of operations, and in the wet season it is impossible to get rations there at all. With the Fokker, the trip can be made in one hour and twenty minutes, carrying a ton of stores, including medical supplies, ammunition, clothing, etc., or eight men can be carried with their equipment and ammunition. The plane can make two round trips a day and if necessary, three, which means that three tons of stores can be moved daily. There is a good landing field at Ocotal and others can be made available when there are sufficient men to protect them. The airplane is playing a very important part and the ground troops rely on them for protection.

Deliver Falcons to National Guard

Distribution of Curtiss Falcon O-11 planes to the National Guard squadrons began recently, according to an announcement from the War Department. The Falcons are being delivered to take the place of the war-time "Jennies" scrapped some time ago. A shipment of 35 was made in the first assignment.

These planes are of the two passenger observation type and are equipped with Liberty engines. They are capable of developing a speed of approximately 135 m.p.h.

Navy Air Orders

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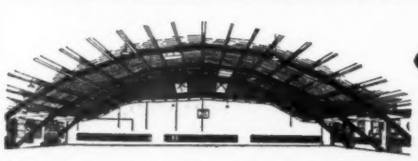

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For sale: Super-Rhone motor, perfect, $250.00. Anzani 10 cyl. like new $200.00. OXX6 with Scintillas and special valves like new $750.00. OX5 with special valves good as new $300.00. OX5 and OXX cylinders with special valves better than new, each complete $15.00. OX carburetor good as new $20.00. Berlings and Dixie 825 not new but perfect $25.00. Berkshires new $10.00. Many other parts; would sell all to interested party cheap; am taking up a new line. Jack Kremel, 1700 East First St., Wichita, Kansas.

Wanted: OX5-OXX6 motors and parts or any new or used aircraft material. Send list of what you have for sale. Name lowest price and full condition. Box 776, AVIATION.

Want good three (3) cylinder motor. Prefer Lawrence L-4. Russell Swift, Ireland Aircraft Inc., Garden City, L. I., N. Y.

Wanted: New production three place ship, also one new production cracked ship or Hisso Standard slightly damaged for parts. Lowest price. R. Troutman, Ethel, Mo.

Wanted: New and used OX5, OXX6 and all models Hissos, also parts. We buy for cash. Hewes Motor Co., Waukegan, Ill.

Wanted: Used OX-5 motors or parts. Also one used OXX6 crankcase. Box 765, AVIATION.

Aeronautical engineer with extensive experience in design of commercial planes desires new connection with responsible firm. Can furnish best of references and proofs of highly successful design. Available Feb. 1. Box 778, AVIATION.

Position wanted: Pilot desires position with company or private citizen. K. L. Micklethwait, 2227 Summit St., Portsmouth, Ohio.

Transport pilot twelve years, all types, 3,000 hours. Good navigator, night flying. Desire to connect with reliable company or private owner. Prefer cross country work. Box 772, AVIATION.

Trade: Marshfield player piano, mahogany finish. Cost $800.00, only used month. Will trade for OX motored ship in flying condition or will pay some cash difference for steel fuselage ship. Make offers. Tom Hedekin, 1444 East 65 St., Chicago, Ill.

William S. Thompson, civilian instructor in aviation during World War, urgent need for you to communicate with your father. Ralph P. Thompson, Hampton Court, Dolphin St., Baltimore, Md.

Bargain in brand new 220 Hisso converted for marine use. Fully enclosed unit job, wonderful performance. Block tested. Will take Curtiss or Hisso motors in trade. Hewes Motor Co., Waukegan, Ill.

Wanted: Standard J1 stabilizer and flippers uncovered. For sale: Waco 9 tail surfaces less rudder, two balanced ailerons, Standard 55 gallon tank, center section 17 gallon. United Airways of N. C., Monroe, N. C.

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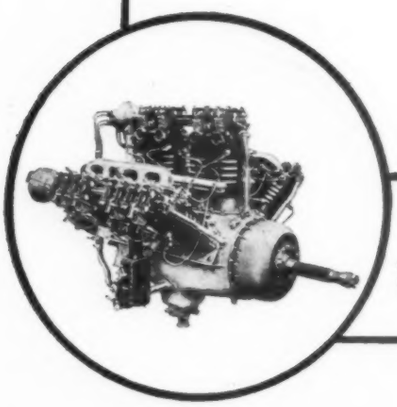

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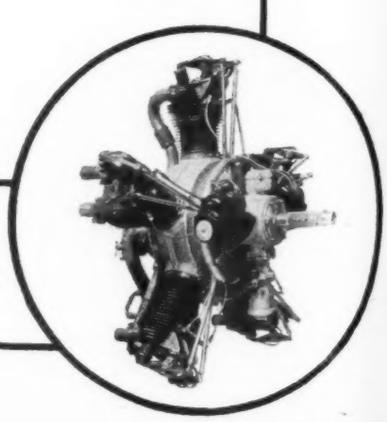

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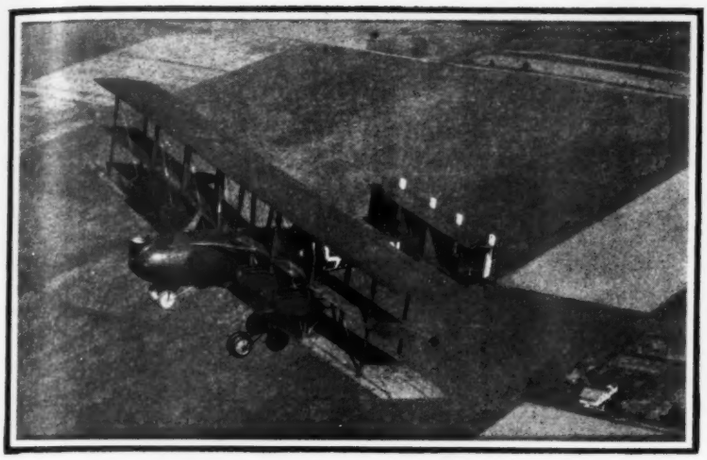

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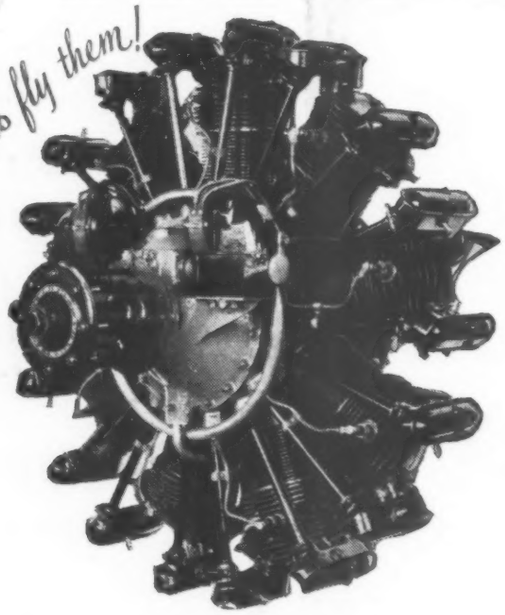
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